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...the journal of cinematic illusions

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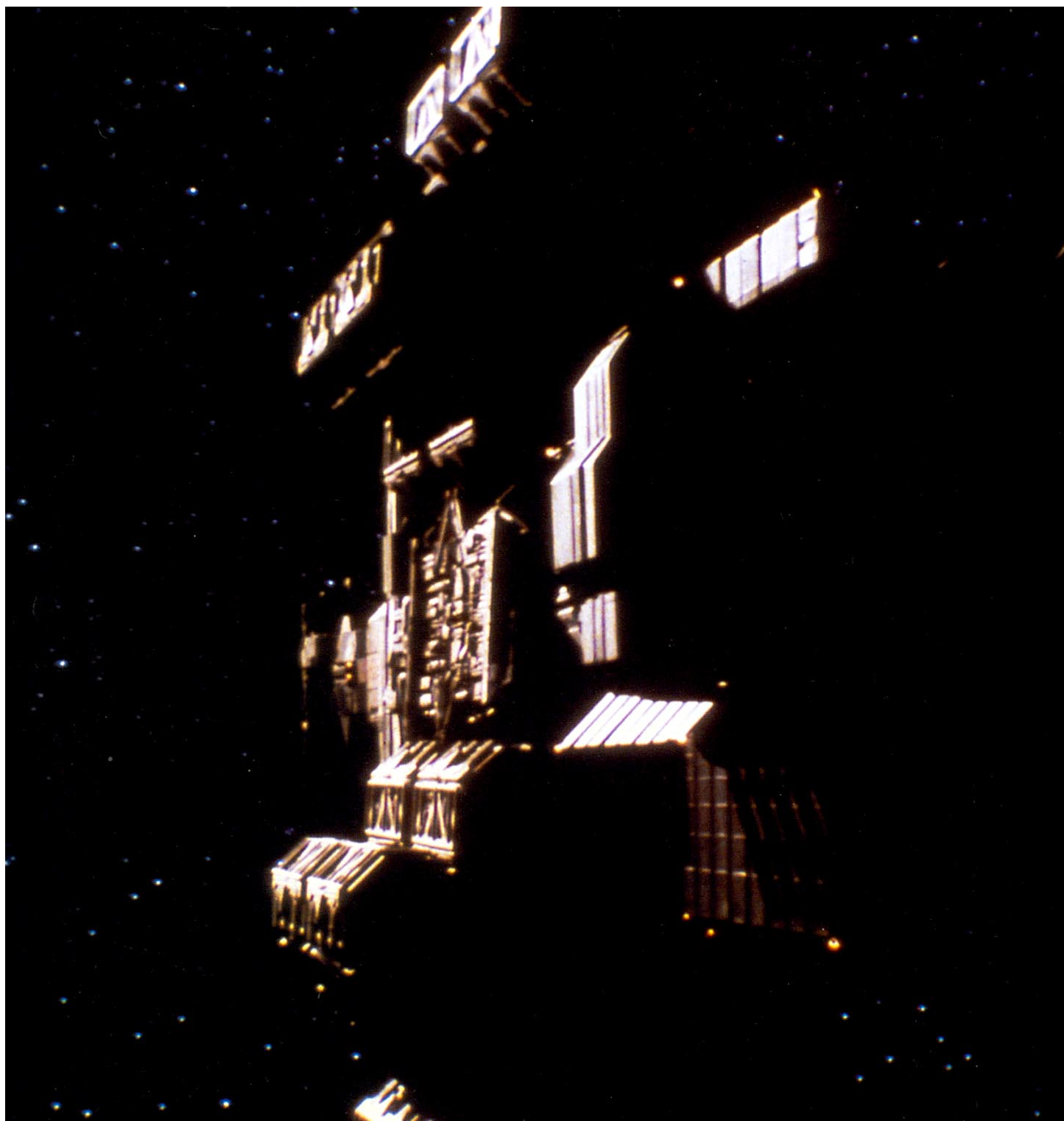
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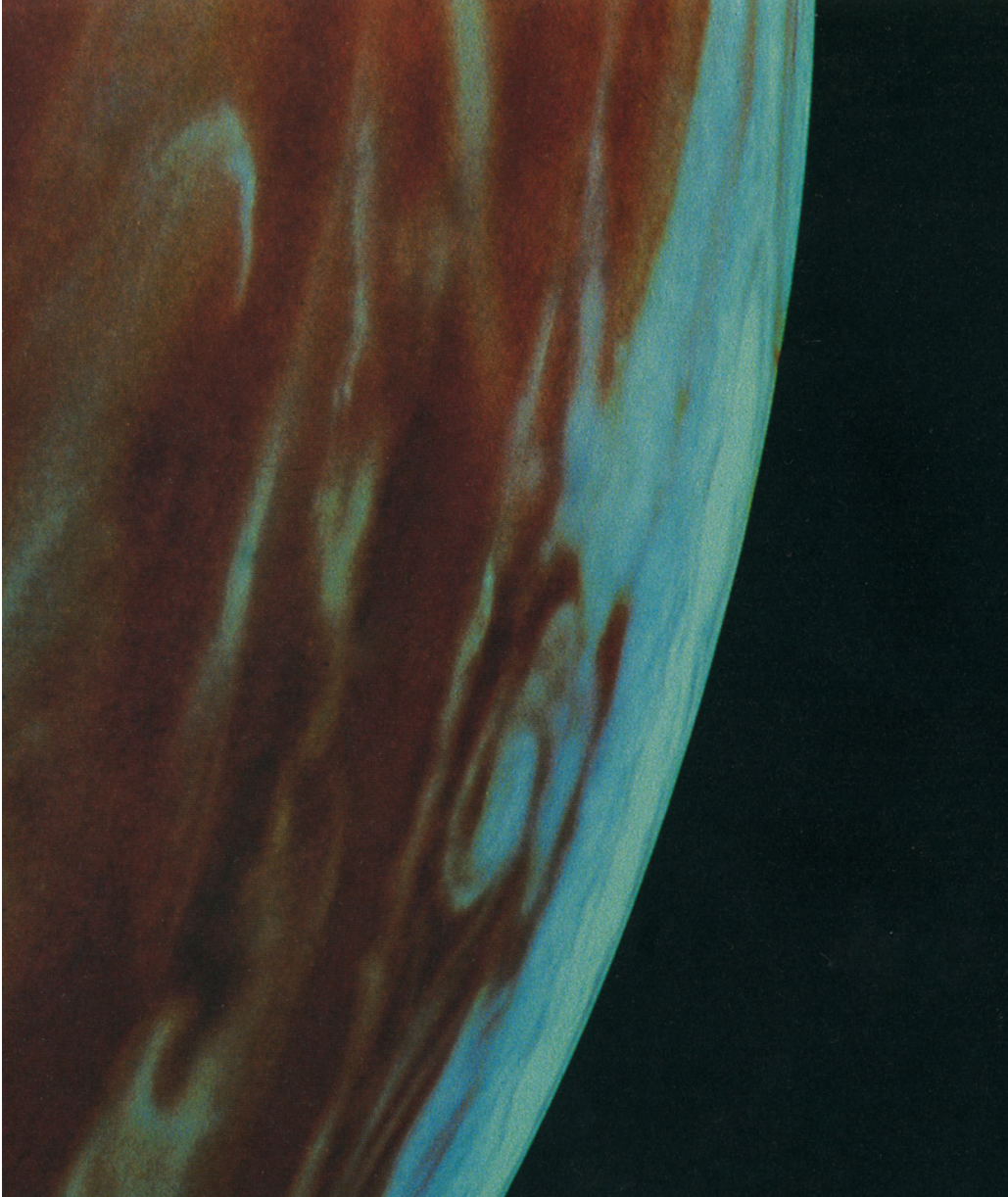
Jupiter Revisited — The Odyssey of '2010' 4

Sixteen years ago, *2001: A Space Odyssey* was launched into the cinematic firmament — a glimmering enigma which, among other things, promptly established a new aesthetic, as well as a whole new set of ground rules for motion picture special effects. Nearly a decade would pass before *Star Wars* and *Close Encounters of the Third Kind*, using computerized motion control photography and advanced compositing techniques, would begin to close the technological gap established by *2001*. When Arthur C. Clarke published his much anticipated sequel *2010: Odyssey Two* in 1982, it was reasonable to assume that it would soon find its way onto the screen, with the full force of contemporary state-of-the-art movie magic brought to bear on its complex effects requirements. Rising to the challenge were producer-writer-director Peter Hyams, futurist designer Syd Mead and visual effects supervisor Richard Edlund. From actualizing a Russian interplanetary spaceship to devising an authentic-looking representation of Jupiter's turbulent surface, the *2010* effects unit fulfilled the demands of the production and in the process established a fresh new look in simulated space photography. Article by Adam Eisenberg and Don Shay.

FRONT COVER — The Starchild appears in the *Discovery* pod bay in *2010*.
Jupiter collapses in on itself at the climax of *2010* — BACK COVER.

JUPITER REVISITED
The Odyssey of '2010'





When Stanley Kubrick's *2001: A Space Odyssey* came to the screen, the year was 1968 and the race to land on the moon. This fact alone certainly would become one of the most talked-about of the year since its creators had gone to great lengths to realistically as possible what future space travel might be like. For the audiences of 1968, the world of tomorrow, a time of regular manned voyages beyond Jupiter.

Just fifteen short years later, however, the world had agreed to direct Arthur C. Clarke's sequel, *2010: The Year of the Space Shuttle*, which had been changed forever. In fact, in the interim, Kubrick's original film had stirred the imagination of mankind had not only set foot on the moon, but had also sent unmanned probes to explore the outer edges of the solar system. The era of the space shuttle in the early 1980s had finally arrived. Suddenly, within a very short time, Kubrick's vision of the future had become a reality and the year 2001 did not seem so very far away.

As a result, in tackling the film adaptation, the production and visual effects supervisor Richard Yurkiewicz and his team had to go beyond the present, but also the future of the original film. And in doing so, they had to deal with the realities of today — flyby images of Jupiter from the close range by Voyager, and the now commonplace images of real astronauts wrestling equipment above the earth. As had been the case with the original, state-of-the-art special effects technology was available to bear on the project; but even so, the filmmakers embarked on a difficult odyssey of their own making to create a new vision of the future in less than half the time it took Kubrick to make the original film.

Completed in 1982, Clarke's novel retells the story some nine years after the original mission. The spaceship *Discovery*, eager to learn the fate of the abandoned craft, American and Russian astronauts agree to a joint mission on board the Russian ship *Ryby* Heywood Floyd (Roy Scheider), the American ship *Discovery* and its dysfunctional computer. With the mysterious monolith, the scientists soon discover that one of the crew members, Dave Bowman, is still alive — and that the alien force has an extraordinary plan for reshaping the destiny of mankind.

Shortly after the book was completed

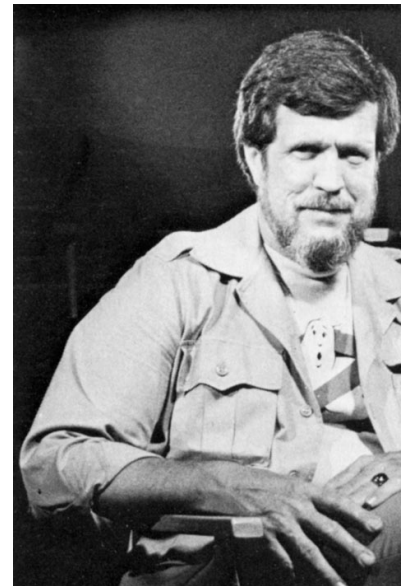
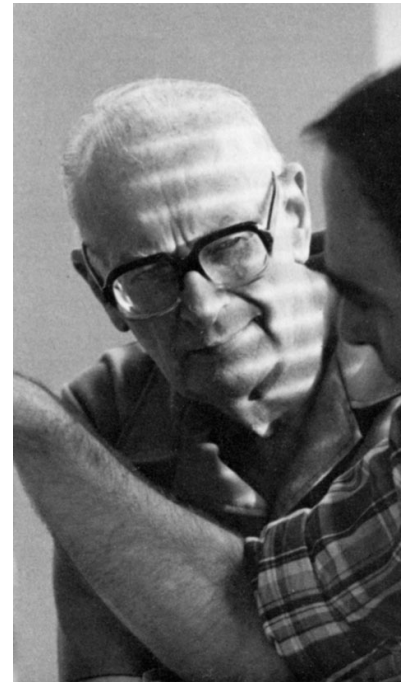
diagrams, but when it came to the Europa change and things that involved color and very deliberate, very conscious compositions, then I would do little paintings and we would discuss color and mood and what we were trying to say emotionally with those sequences."

Jenson would work out the various ideas in rough sketches and then, when they were approved, Brent Boates would execute a finished storyboard. Sometimes, however, reaching that point of acceptance was difficult because of the problems inherent in conceptualizing many of the sequences. "We had to approach things very carefully because of the lighting throughout the show," Jenson continued. "In the *Discovery* boarding sequence, for instance, the *Discovery* is turning, and it was incredibly complicated because we had a constant light source on it as it was turning and our men were traversing and the light was constantly changing on them. So through that whole sequence, we had to be very careful of where our light was and, as a result, where our shadows were. That sort of complexity to the shots was true throughout the show. Every time we showed a planet or moon with a terminator, we had to be certain that it was consistent with the way our ships were lit and the way our people were lit. So it was very involved in that way. I think the *Discovery* boarding sequence was probably the toughest thing I've ever worked on, for that reason."

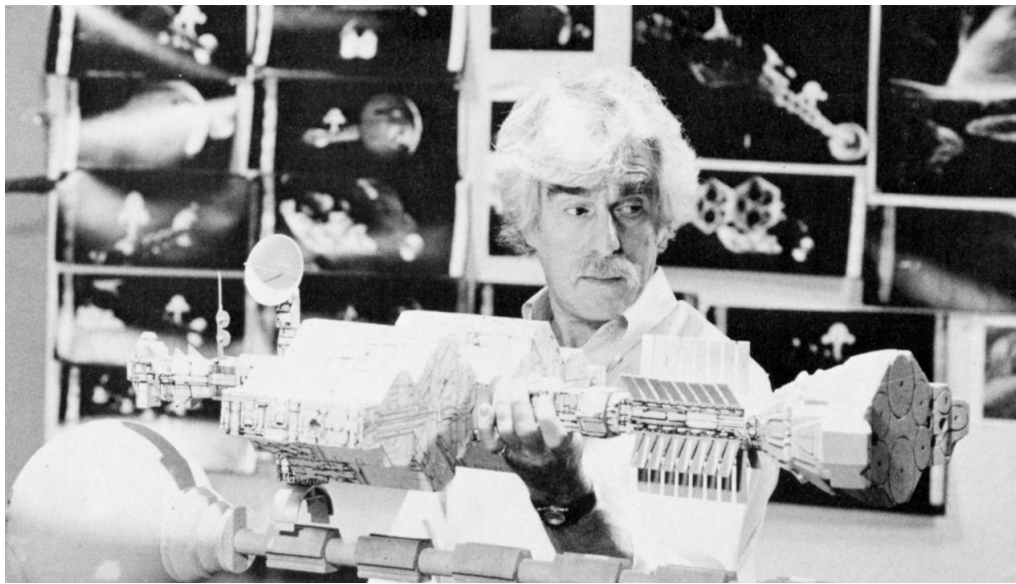
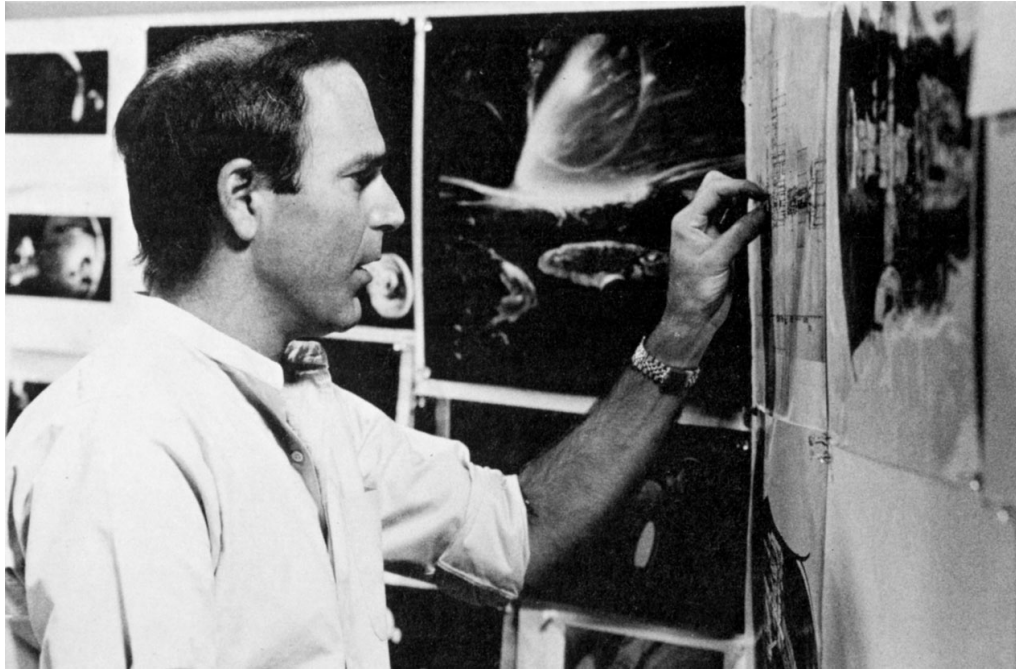
Science fiction master Arthur C. Clarke confers with director Peter Hyams during a visit to the 2010 set. / Four-time Oscar-winning effects supervisor Richard Edlund and his Entertainment Effects Group pioneered a new look in simulated space photography for the long-awaited sequel to 2001. / Visual futurist Syd Mead designed the Leonov exterior and provided specific detailing concepts for the vessel's interior sets. / In an early conference at EEG, Hyams studies Mead's drawings for the Russian craft. / The initial phase of the model-building effort entailed the construction of a three-foot-long foam core mockup of the Leonov — being gauged against a like

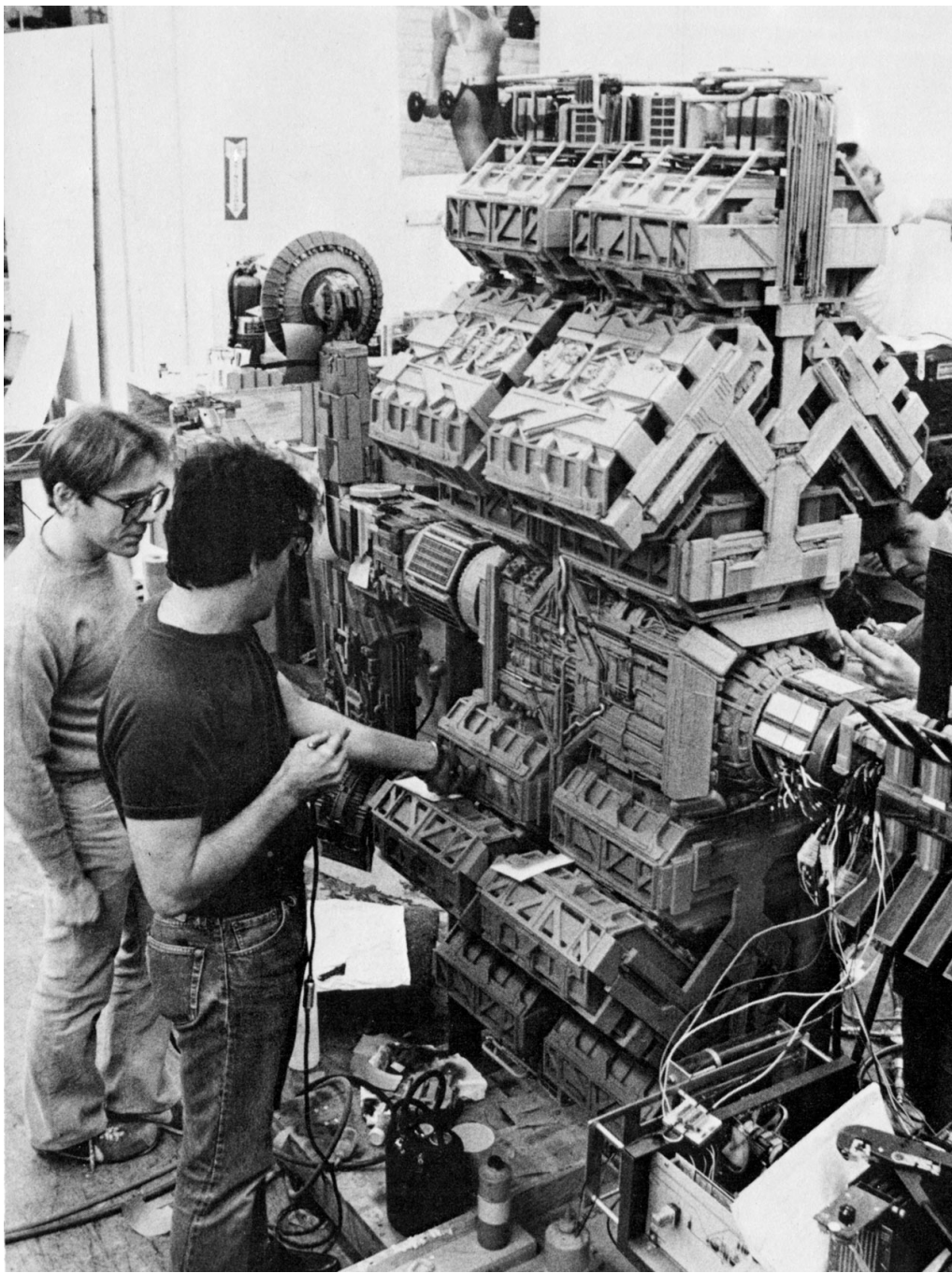
Despite such difficulties, once the boards were approved, most did not require further alterations. "Occasionally, though, there were cases where we would run into one or two drawings that needed to be changed — some for technical reasons. For instance, all the sequences where we had the guys on wires were easy to draw, but when I went over to the soundstage and saw the limitations of the rigging to actually fly those guys, a lot of the concepts had to be changed because of the pure physical problems of the rigging and how it worked against the sets. So there had to be some very fast compositional changes there, both to keep from seeing the wires and to accommodate the fact that they could only move in certain ways. The wires were hooked onto the actors' hips and they could go in certain directions between two parallel tracks, so there could be no turns in space and things like that."

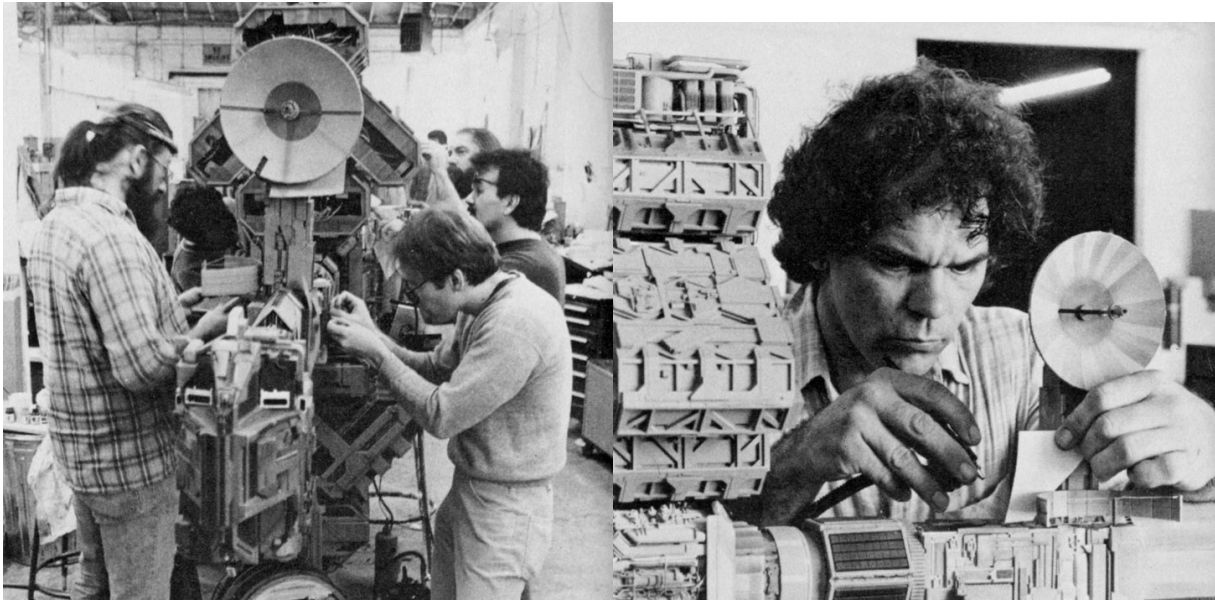
All of the storyboards were designed to take into account not only the realities of film production, but also the realities of space. "Space is so vast and essentially black," noted Edlund, "that it doesn't offer a lot of compositional possibilities unless you create them — unless you set up the scenes from the standpoint of composition before you shoot. So the whole picture was designed very carefully before we could start shooting any of the models. For instance, the geography of space was designed into all the boards from the start. We had a geography of the situations in mind for the entire picture, enabling us to know where we were in relation to the sun











think it was successful, since you always seem to know 'where you are' when cutting outside the ship."

As Hyams worked to complete his screenplay and Jenson labored over storyboard compositions, another aspect of *2010's* conceptualization was also underway — the designing of the Russian spaceship *Leonov* and its attendant hardware. Acting on the recommendation of Richard Edlund, Peter Hyams engaged Syd Mead for the task. "I doubt if there was anybody much more important to the project than Syd in terms of the design concept for the film," said Hyams, "which from beginning to end was conceived to be functional. As I had in *Outland*, I wanted things to look like they really *did* something. Syd is really amazing at being able to extrapolate real surface detail and make it look convincing. He is not one of those people who just paints wonderfully imaginative paintings — he is an industrial designer by trade, and the bulk of what he does is *real*."

Mead, whose expertise had already been tapped to make the speculative futures in *Star Trek - The Motion Picture*, *Tron* and *Blade Runner* seem like reality, approached the task of creating the *Leonov* with customary thoroughness and enthusiasm. "During our first meeting, Peter described to me very exactly what he wanted the spaceship to do. He wanted it to look more like a complex than the *Discovery* — a working complex or habitat with a rocket motor attached to get it to Jupiter. So I knew we weren't into sleek shapes and nicely encased tubing. We were into a pretty utilitarian-looking complex which, for reasons of organization, I arranged along a long axis. The other parameter he stressed, along with the fact that he wanted the overall length to be about three hundred feet, was that in building the interior sets for the ship, he wanted to do away with weightlessness so that he could have dramatic action going on inside the ship without necessarily having to duplicate the floating effect of 'zero-G.' So, to fulfill this requirement, we decided to rotate the cabin block."

In addition to parameters dictated by aesthetics and practicality, Mead had also to take into account the fact that the *Leonov* was supposedly built by the Russian government, and therefore needed to reflect the sensitivities of its designers. "To give it that strange 'Russian look,' I knew it had to be a little bit awkward, so my original intention was to have a spur come off the main axis and that would be the bridge. Then your docking port would be in line so that, in effect, you could be in the bridge and look out the window and monitor the docking process at the port end. But Peter, after seeing that, decided that he wanted it all on one axis so that it would make a statement immediately and you could do sort of an in-head establishing shot. From

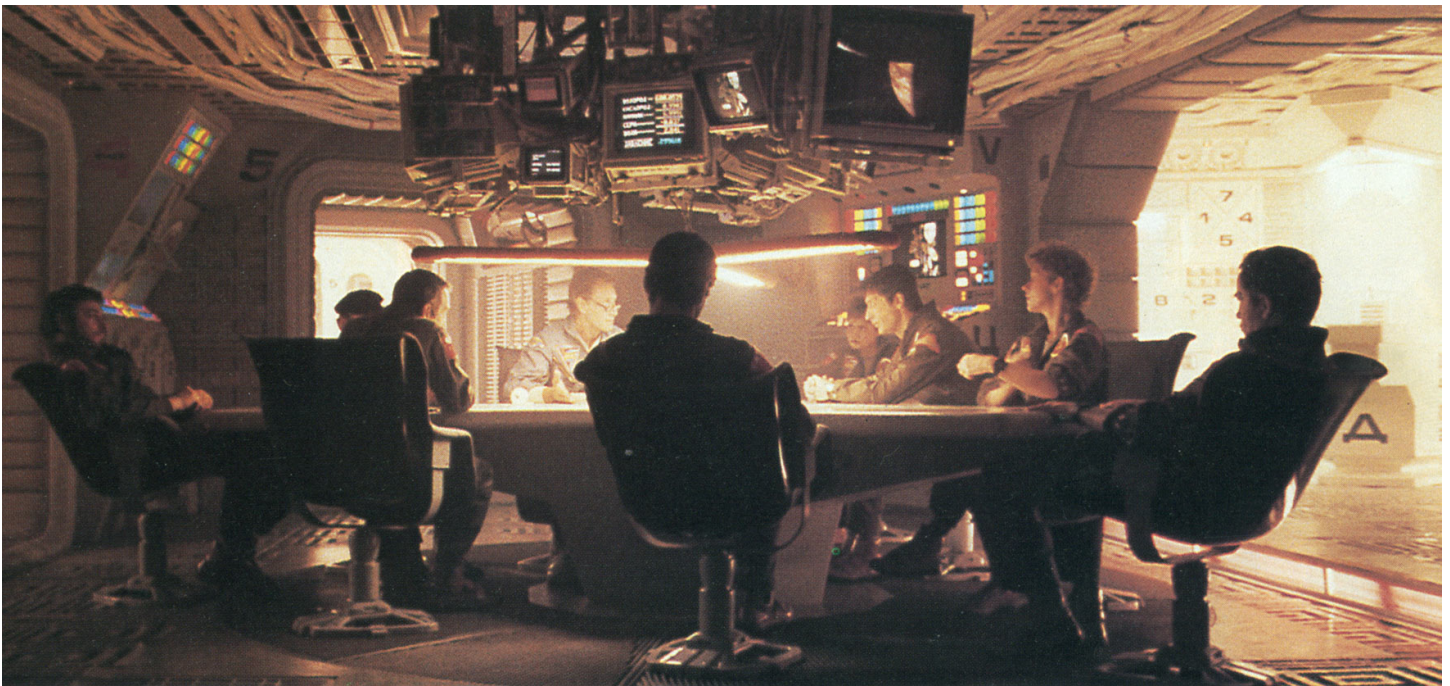
Modelmaker Seldon and I confer during airbrush painting of articulated half-foot L Mark Stets crew adds nearly complete / Airbrush garnishes community with further and Leslie last-minute wiring. / I mechanic technician



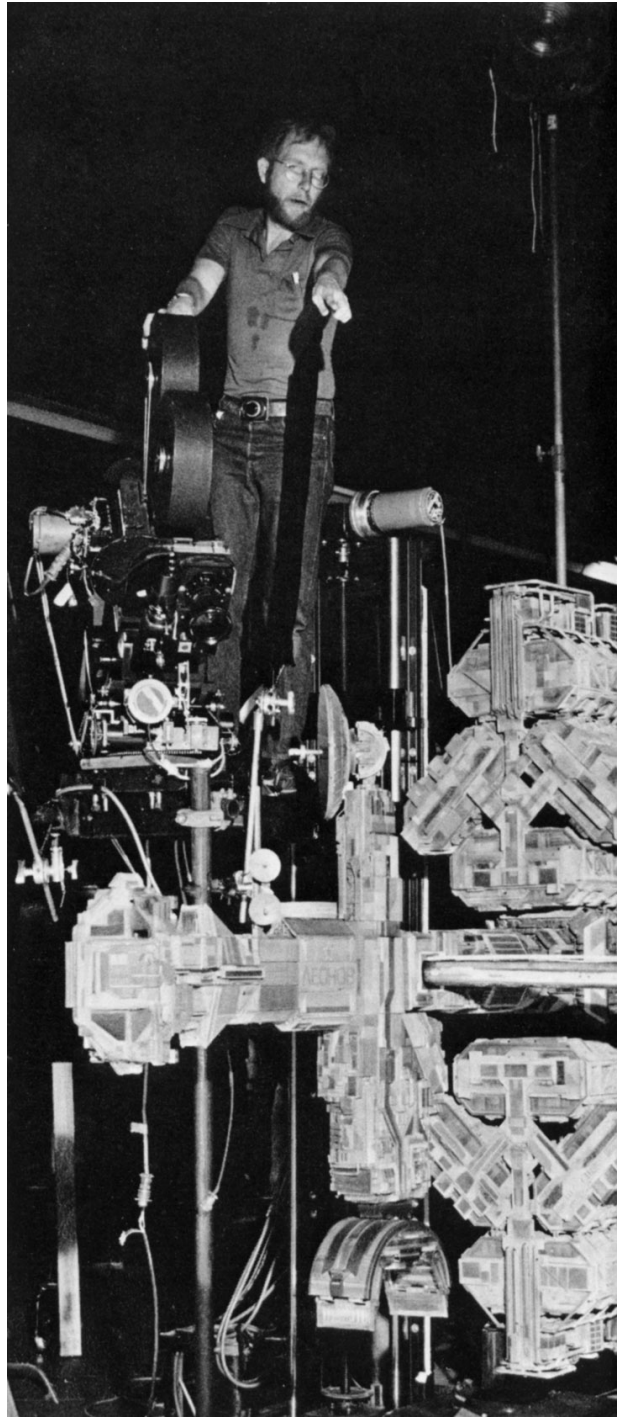
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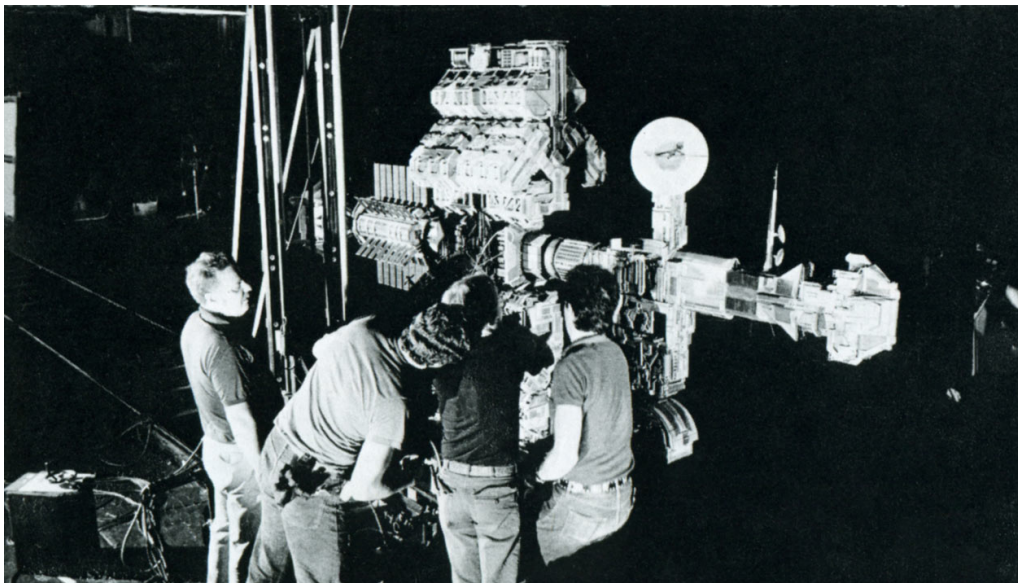
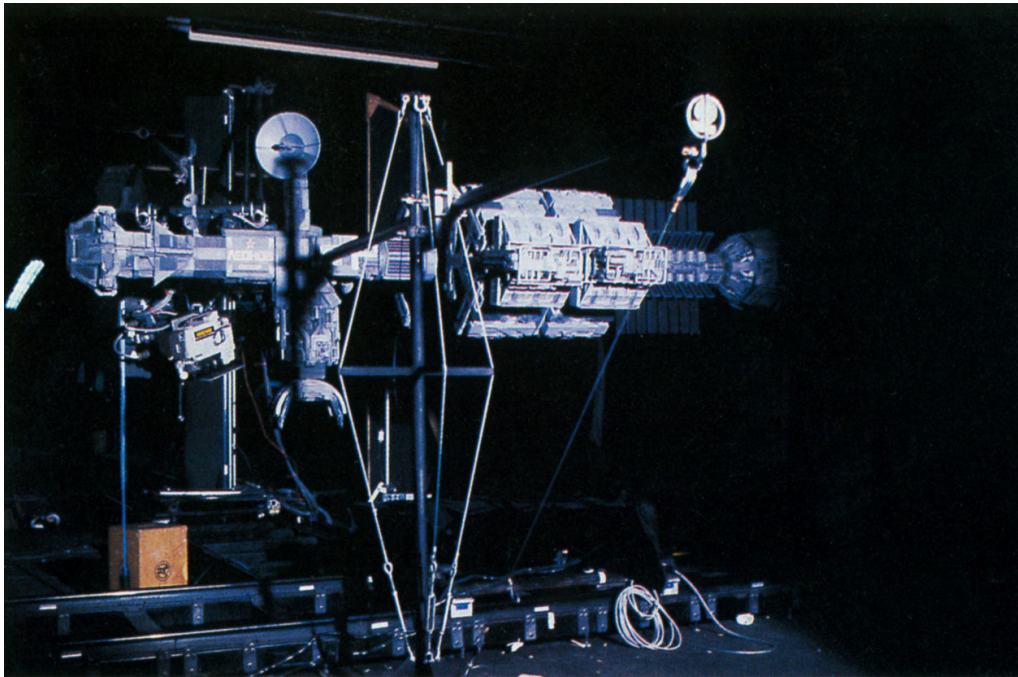
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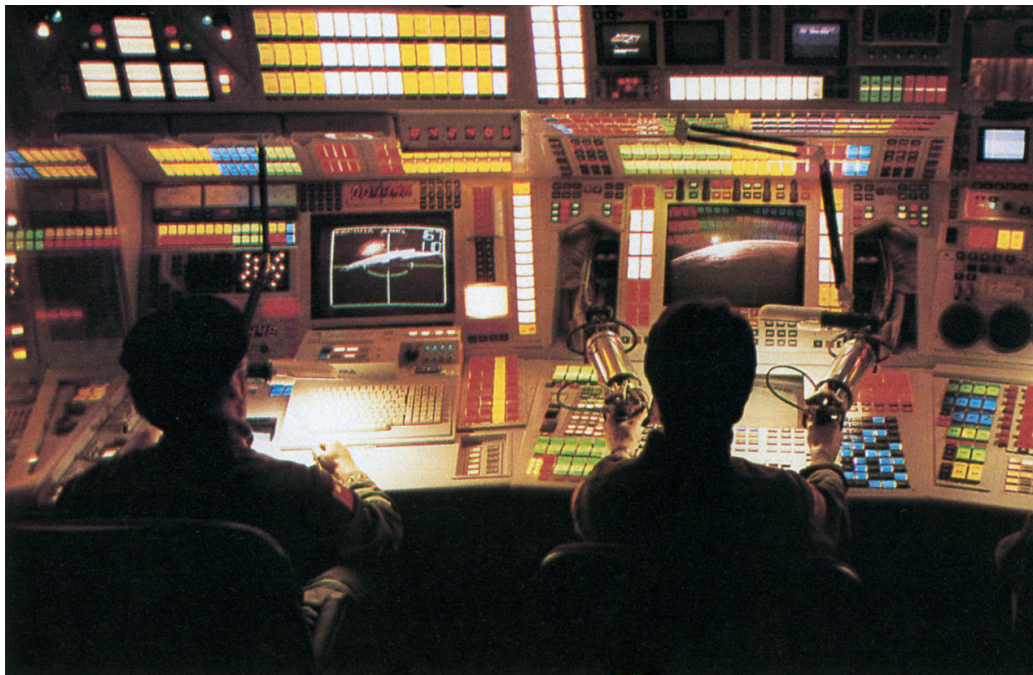
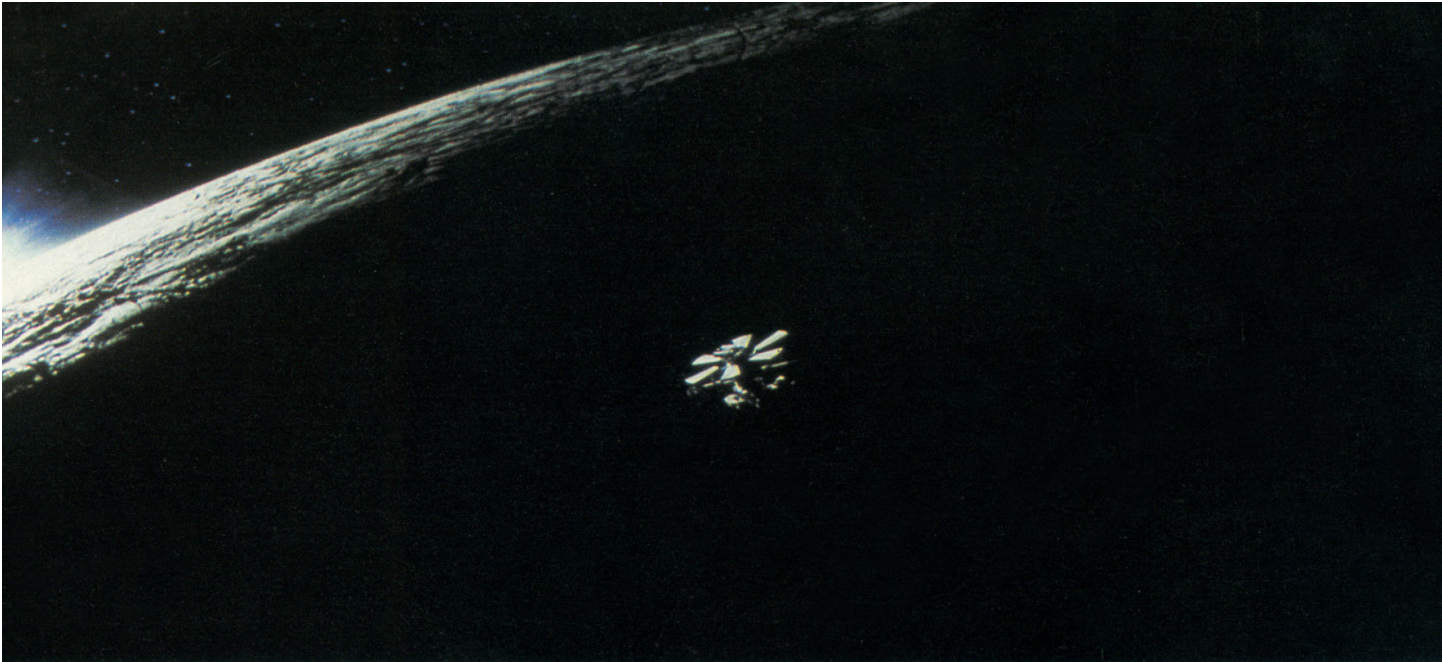
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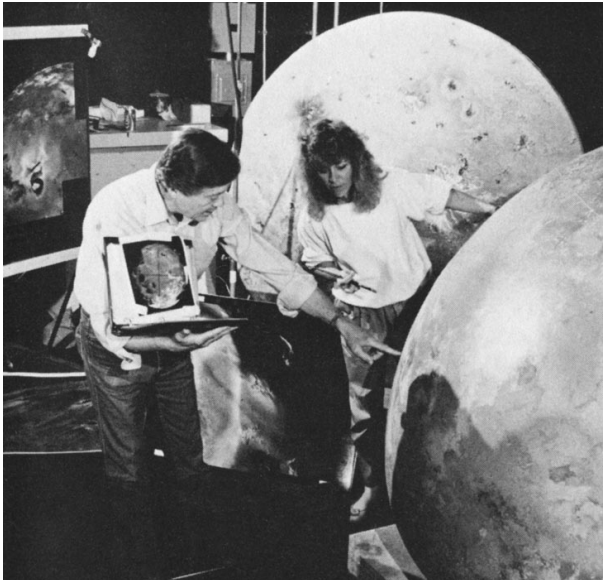


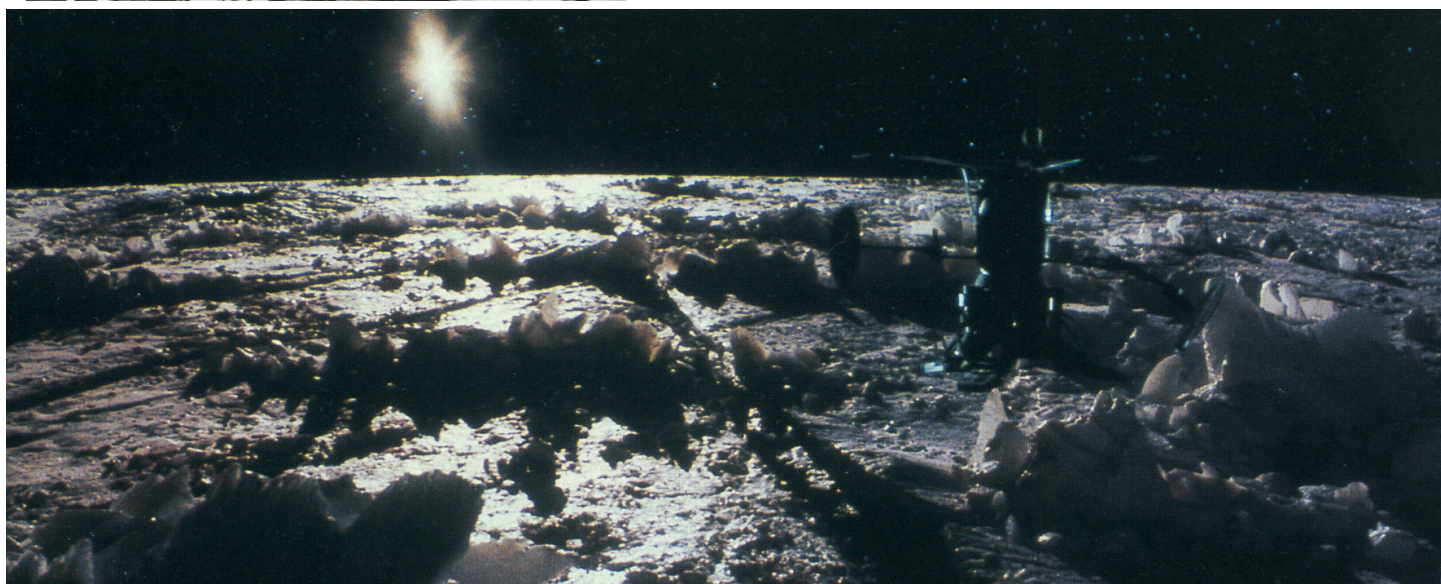


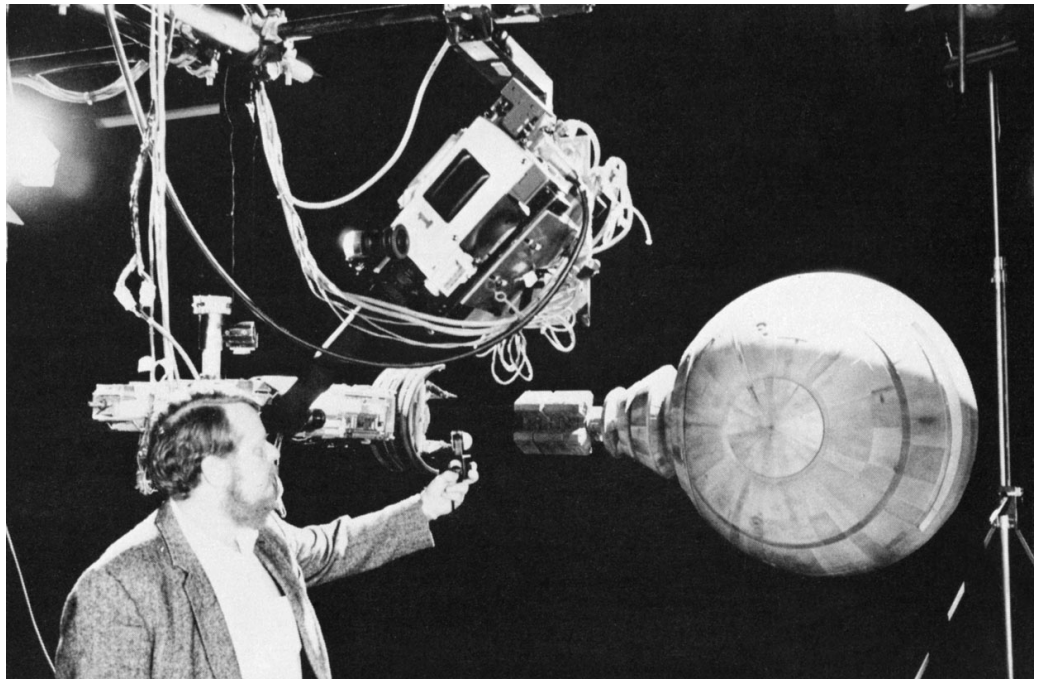






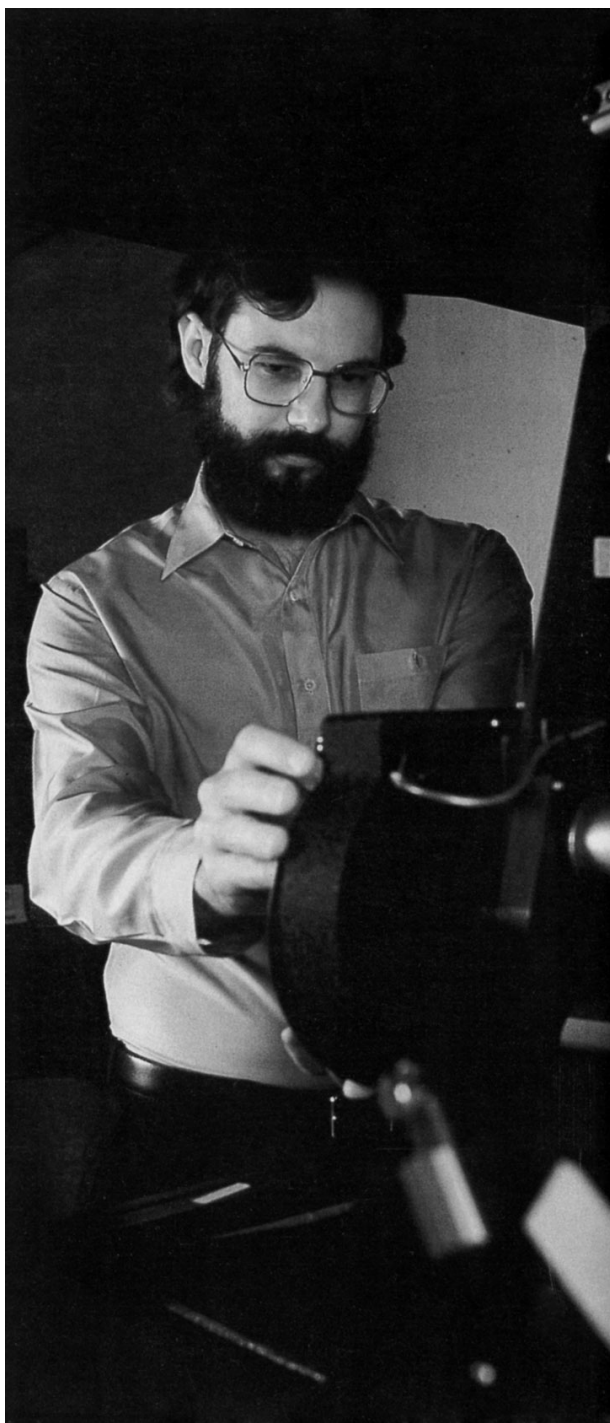




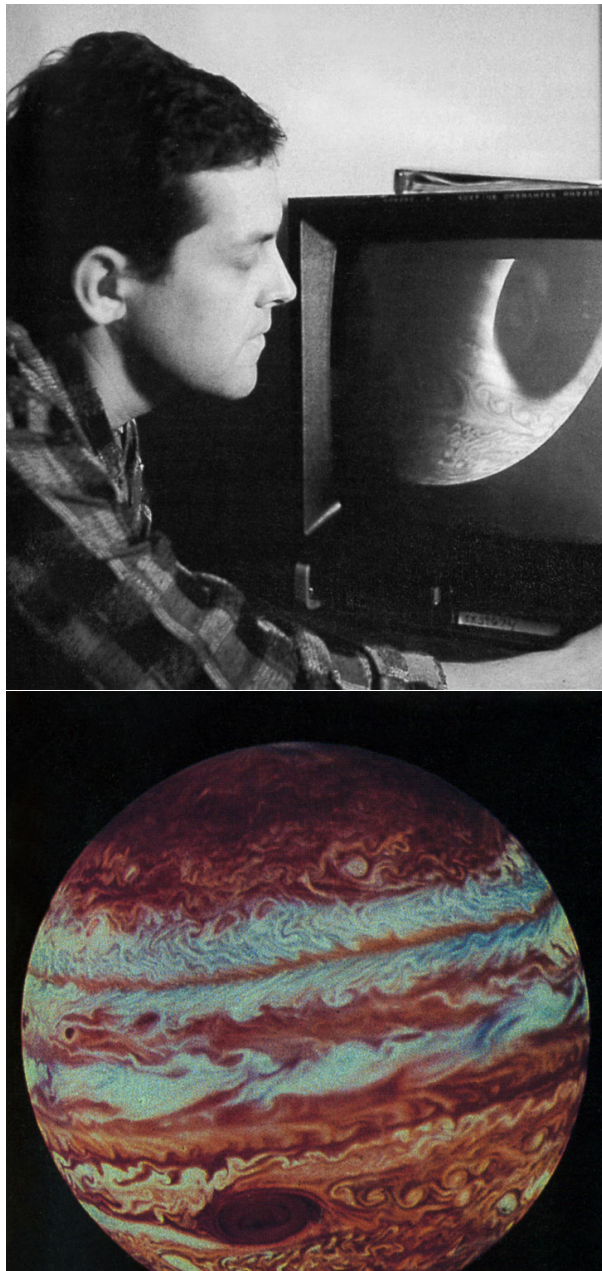


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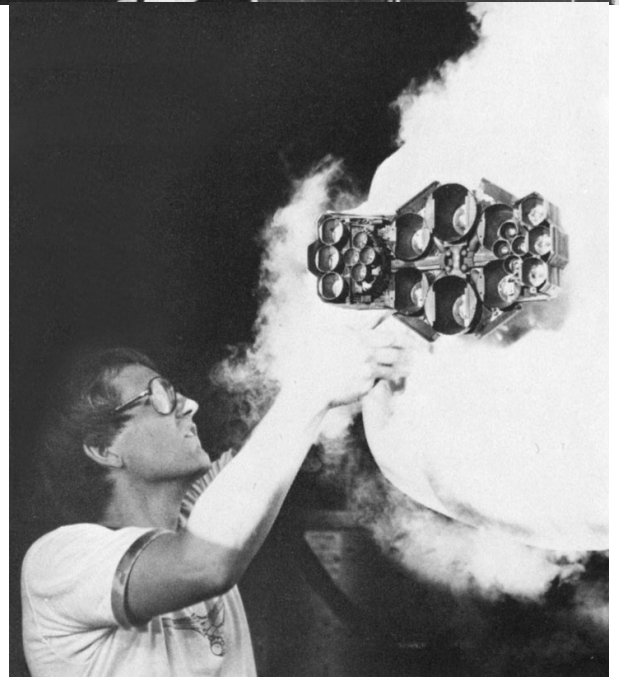
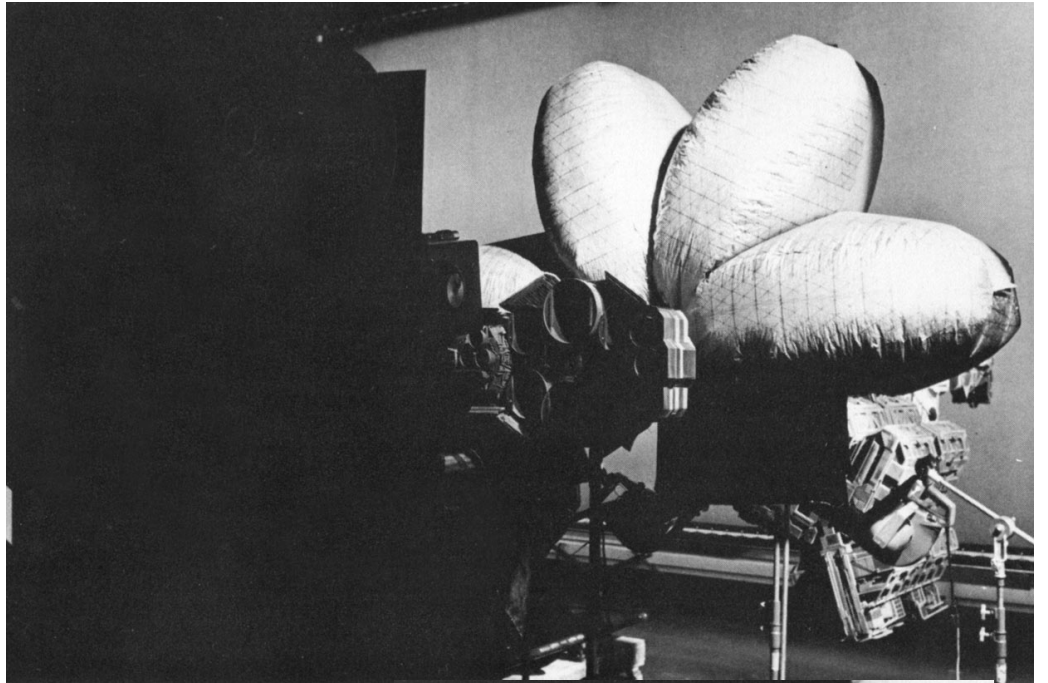


doesn't even get solid until the very middle, which may be as small as the earth. In any event, what's going on underneath is really what's causing the motion on the surface. We know that there are various gases that swirl around at different heights and have different colors and temperatures, but beyond that, scientists don't have the faintest idea of what's really going on underneath Jupiter's atmosphere. They do have a lot of ideas, but many of the theories radically disagree with each other.

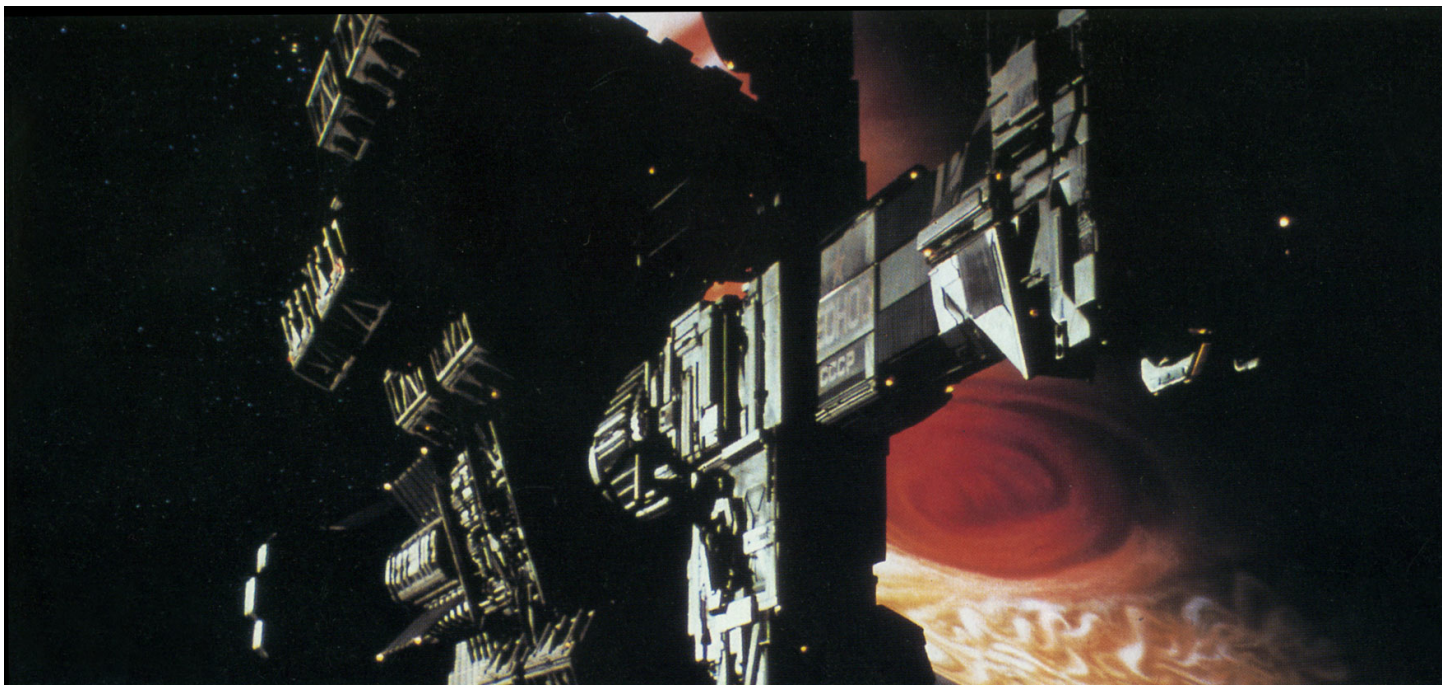
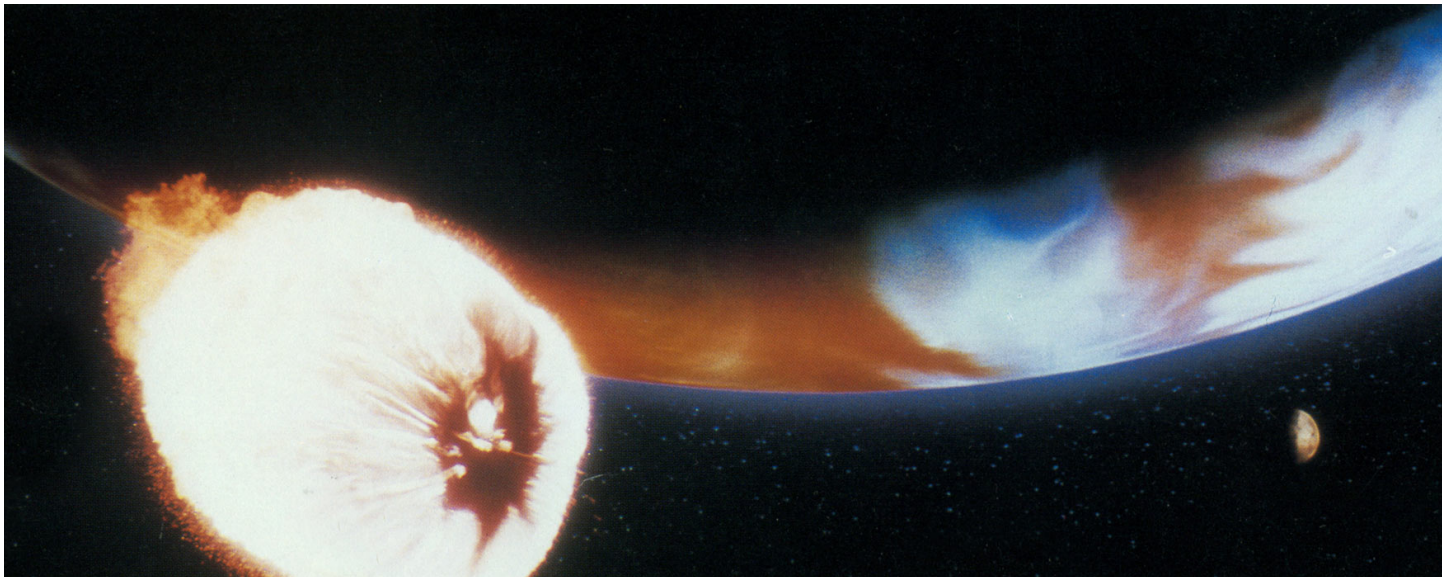
"Using relatively state-of-the-art fluid dynamics code, there are major things that still cannot be accomplished based on the physics of today. People are designing spacecraft, airplanes and everything else with programs which have these problems in them. Most of the problems come from the fact that they can't afford to compute the *real* solutions, so they make compromises, and these compromises lead to certain distortions in what actually happens. We ran into a number of these things. For example, based on our first model of the planet, the red spot started tipping over with time, because it was a vortex and we had a swirl there. So we had to figure out how to get it to stay put while it was rotating around. To do this, Craig spent some time reading technical papers from JPL and PhD theses from Cal Tech, and eventually pieced together a working model. However, for other cases, in order to make the planet look reasonable, we had to essentially abandon some of the correct numbers for physics and put in numbers which were quite erroneous for things like viscosity, rate of motion and such, so that when the image moved, it looked good. If we had used the real physical numbers, the thing wouldn't have functioned like Jupiter at all, since what's really causing the movement on the surface of Jupiter is something under the atmosphere that we don't even know about. So we had to solve our problems with a process that worked on a surface level only."

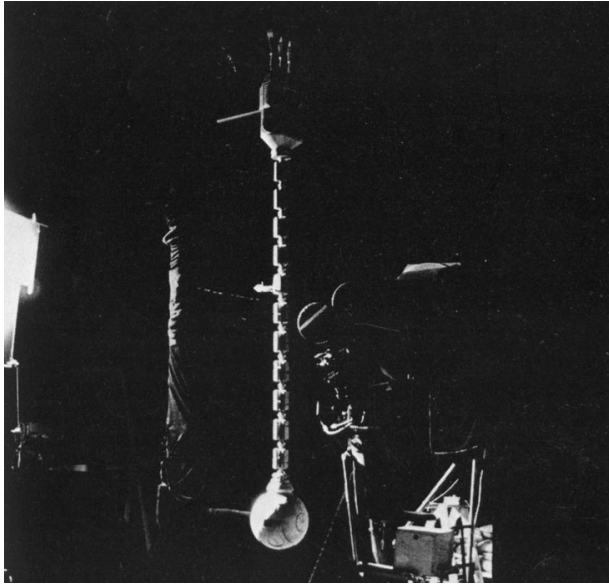
Though strenuous attention was paid to simulating the natural appearance and movement of Jupiter's surface, aesthetic judgments dictated that certain liberties be taken with the digital imagery. For one, the motion of Jupiter was accelerated. "Our images were moving a couple of orders of magnitude faster than the actual wind fields on the planet," Upson admitted, "but if they hadn't been, there would have been no point in doing it. In an eight-second shot, there would be no noticeable movement on the planet at all. So we had to speed it up just to get the effect. The problem was that we couldn't really tell how much to increase it until we put it on film and tried different speeds. The motion is very complex and we couldn't really predict what we were going to get without doing the computations first. So we put out some film and Richard would let us know whether he wanted it faster or slower. Determining the right speed was very tricky because, on the one hand, if you go too fast the equations become unstable and you get unpredictable results; and on the other hand, if you don't go fast

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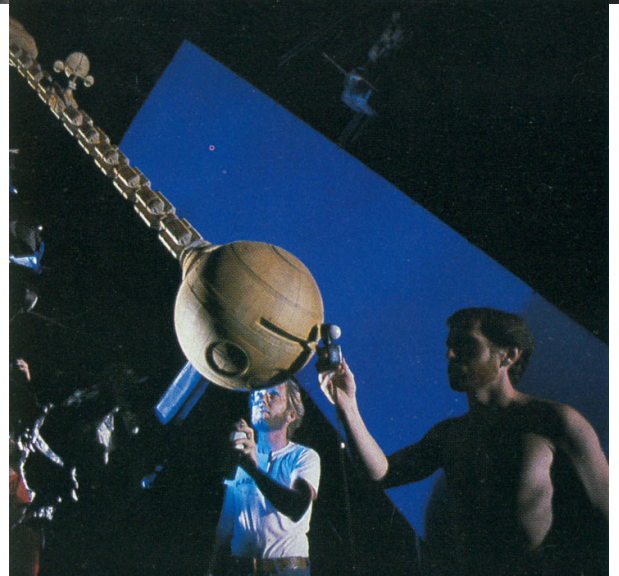


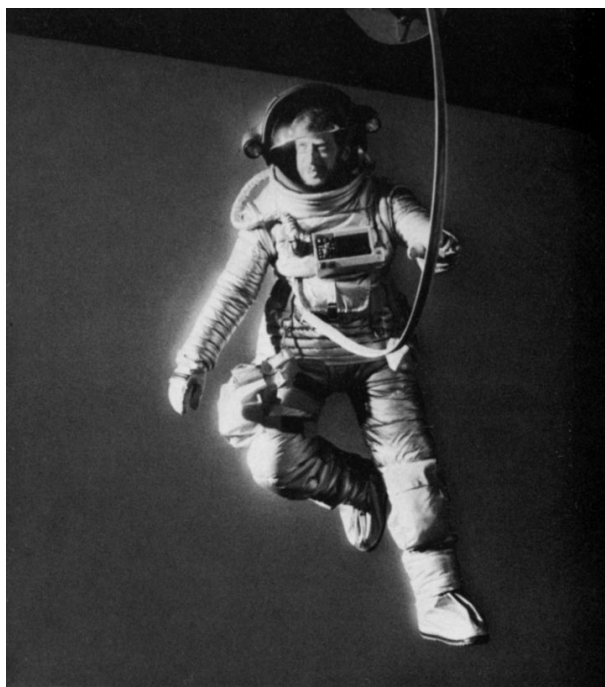
"We knew that we had to go into Jupiter orbit," Mead explained, "and Peter really wanted to have the ship go in bridge first. He wanted the dramatic opportunity to have this 'thing' permanently stowed between the two halves of the bridge, have it come out forward of the ship and then open up like a big iron umbrella. It would then set itself with braces, and during reentry there'd be all these sparks and wonderful ablative glows coming off the front of the ship. So I designed this big, incredibly over-engineered-looking knuckle that would control all these plates, because if they fold all together like an umbrella, they've got to unfold and you've got to fill all these triangular sections in between the oblong plates. So I did it, and we were satisfied that we had a really neat setup for this."

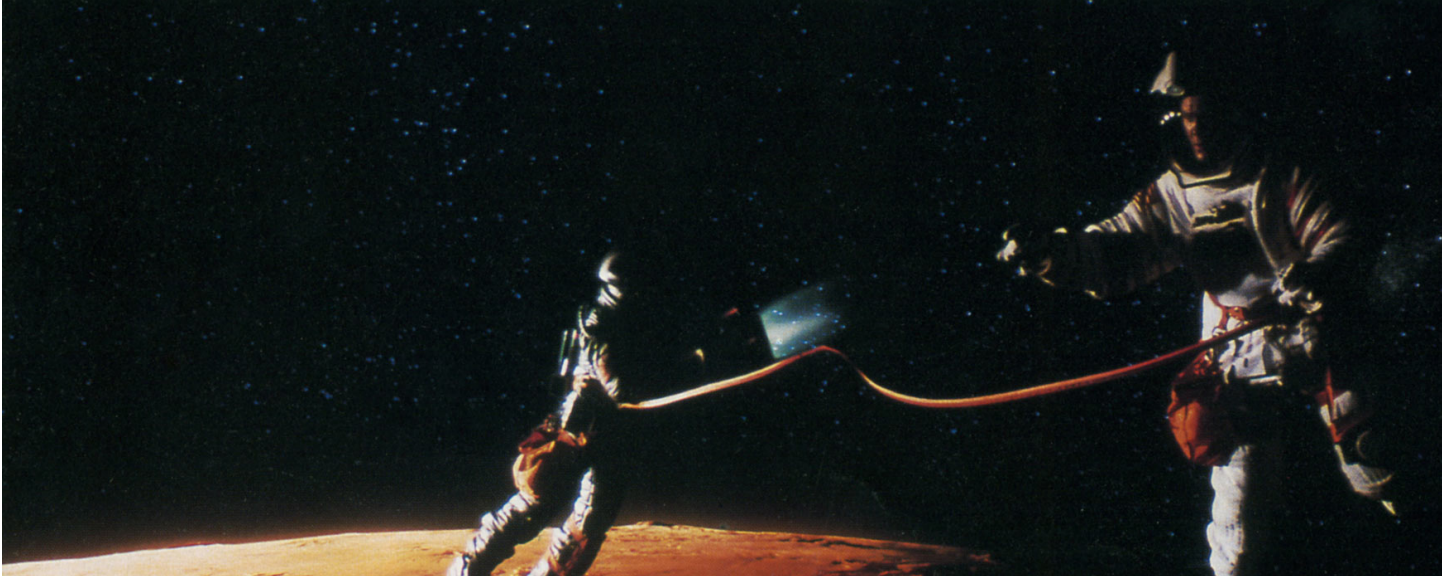
However, despite Mead's and Hyams' enthusiasm for the design, it was essentially shot down by Richard Terrile, 2010's technical advisor. "He told us: 'First of all, just from the sheer standpoint of efficiency, you would use your own engines for braking.' He did say, however, that there was a way to use an inflatable volute, which is a carbon-fiber material, and you just inflate this big bag near the rear of the spacecraft and then use your rocket thrust and the bag itself to brake your ship. So with that idea in mind, I designed an add-on to the *Leonov* which had to be in place then for the whole journey."

Once the design was finalized, it next had to be built and









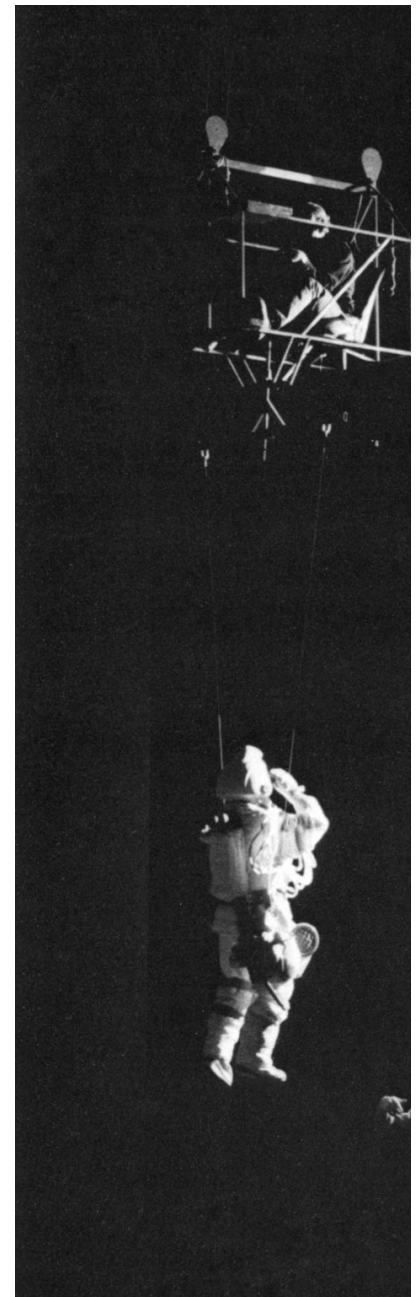
mobile 24-frame video playback system — they had, with the subsequent de facto breakup of the Trumbull organization, formed Video Image Associates with the intent of doing similar work on other films.

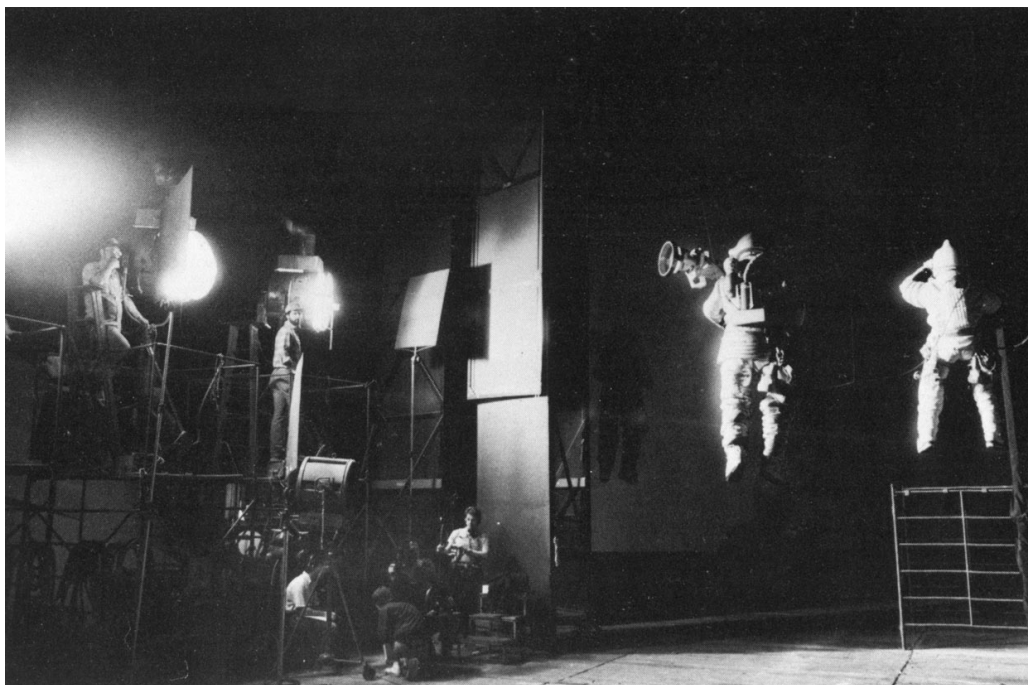
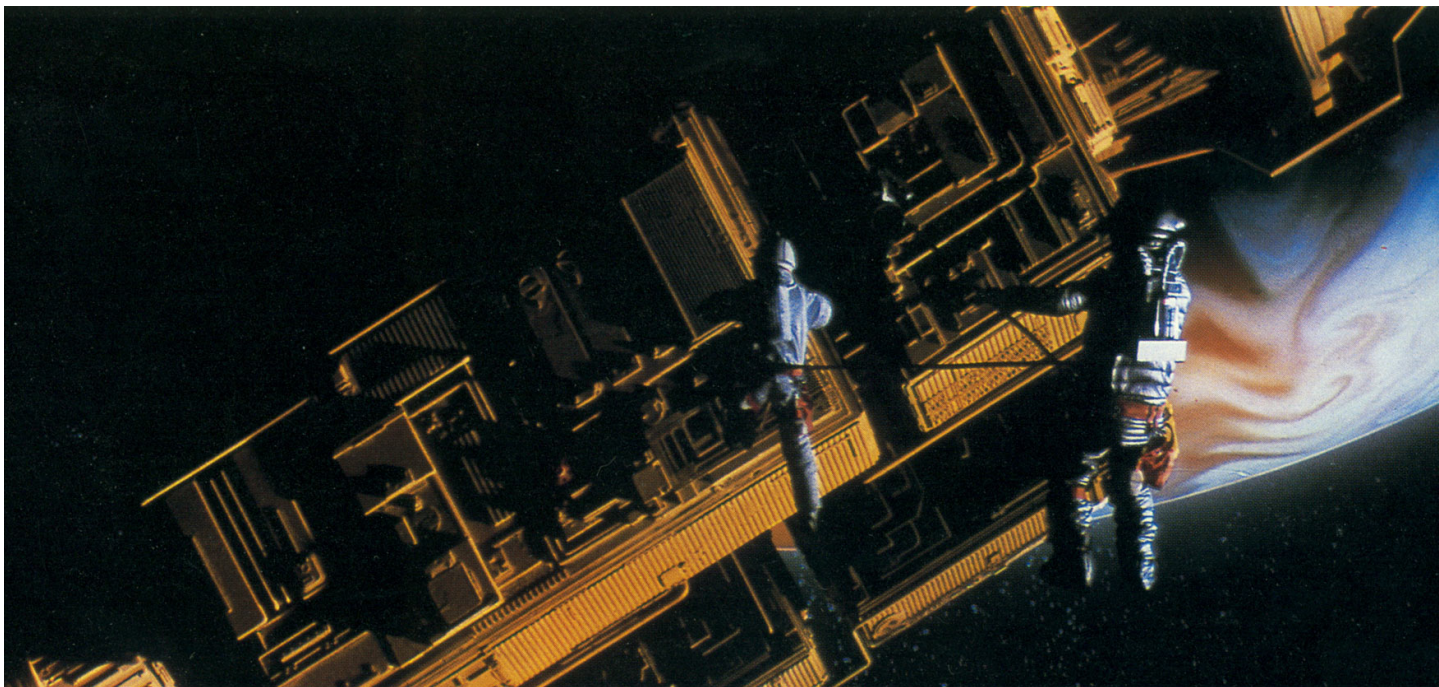
Shortly after M-G-M announced its planned production of *2010*, McMurry wangled a meeting with Peter Hyams and, on the strength of a heavy-duty reference from Douglas Trumbull, walked away with a contract for all the video graphics and video playback work in the film. With only sixteen weeks before commencement of shooting, Wash and Hollander launched immediately into the production of readout material while McMurry and Gunner concentrated on developing a large-scale mobile playback system that would allow for maximum flexibility and responsiveness on the set.

"Richard and I were generally responsible for the overall technical scheme of the movie," said McMurry. "We knew we had to produce a lot of good-looking graphics in a short period of time, so we opted to take the first part of our schedule to write software for creating graphics, rather than just try and start producing graphics right away. That way, we kind of built up a head of steam. Peter wanted a low-resolution look to the graphics, which was fortunate because we wouldn't have been able to get anything else in volume in the amount of time we had. A lot of the work we did looked like vector graphics, in that it was largely line drawings, but everything was actually done on a raster graphics system — actually an IBM PC with a Cubicomp frame buffer. We always tried to make the best-looking image we could, and if John — who was our main 'artistic' eye — felt that the design of a particular image would be better with a solid on it, or something like that, then we had the capability of doing shading or building solids. Sometimes, if we wanted to highlight a particular section of the *Leonov*, we might fill solids in on that one section and then the rest of the ship would be in wire-frame form. So we used it as an artistic tool, rather than for any sense of realism.

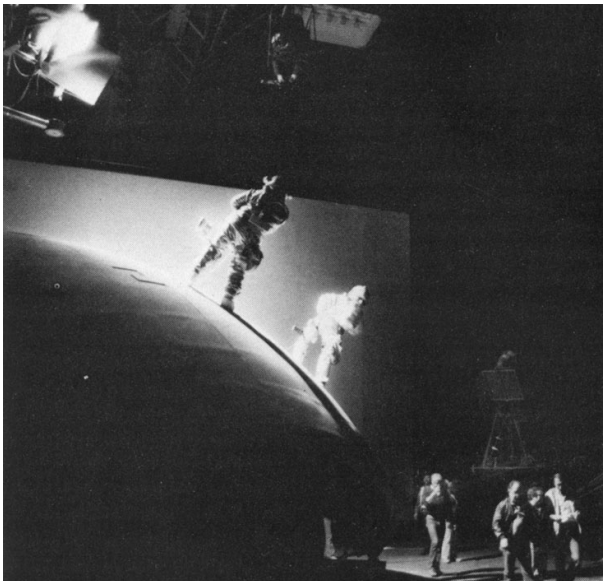
"We digitized everything we could get our hands on — the *Leonov*, the *Discovery*. We even digitized a head for a medical scene. We created about six tapes for use in the medical bay, and one of the things we wanted to have in there was a body or a head or something. We settled on a head, but we utilized a rather unorthodox method of doing it. We had a faceted styrofoam head — which was actually left over from *Brainstorm* — and we marked every point on the head and numbered every polygon. Then we went in on a lathe that was calibrated so that we could move a pointer over the head and measure the x-, y- and z-axes for each point. We did that for one whole half of the head. Next, we hand-keyed all those points into the computer, and Richard then realized the other side of the head from the first side, so there was now a full data-base for a human head. When that was generated as a filled solid, it looked identical to the original

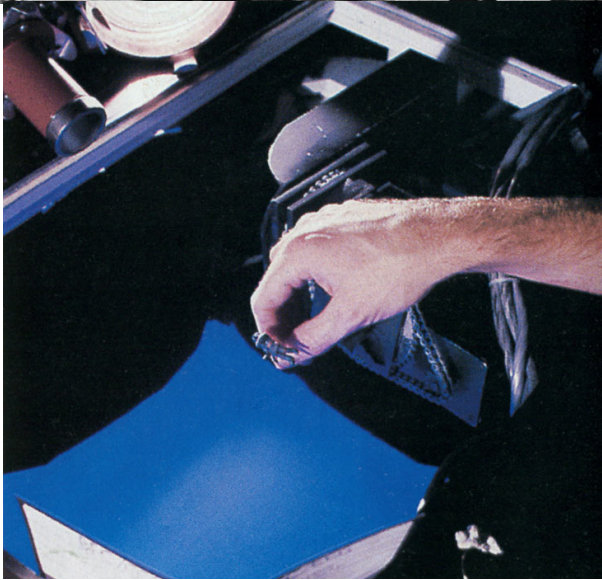
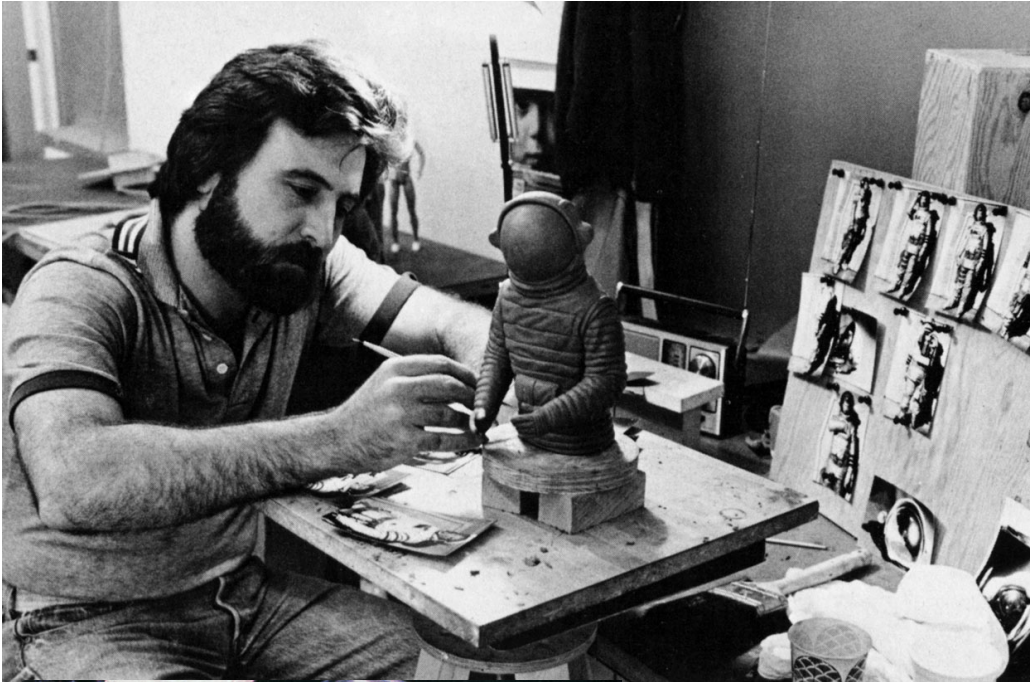
Three operators — including one overhead — were required to 'fly' each performer, via wires attached to either side of a leather harness worn under the spacesuit. Since the wires were connected at the actor's precise center of gravity — adjusted to include the suit — by moving his limbs, the gravity-bound spacewalker could pivot into a variety of seemingly weightless positions. / Curnow and Brailovsky connect with the tumbling Discovery. / The two astronauts make their way to the command module and scale its outer surface as the ship continues to rotate. Since the set piece on which they were climbing was stationary, the sensation of movement was suggested by crane-mounting the lights and swinging them through the shot. Later, in postproduction, a spinning starfield and planet would be composited behind the actors. / Stagehands prepare for another shot while





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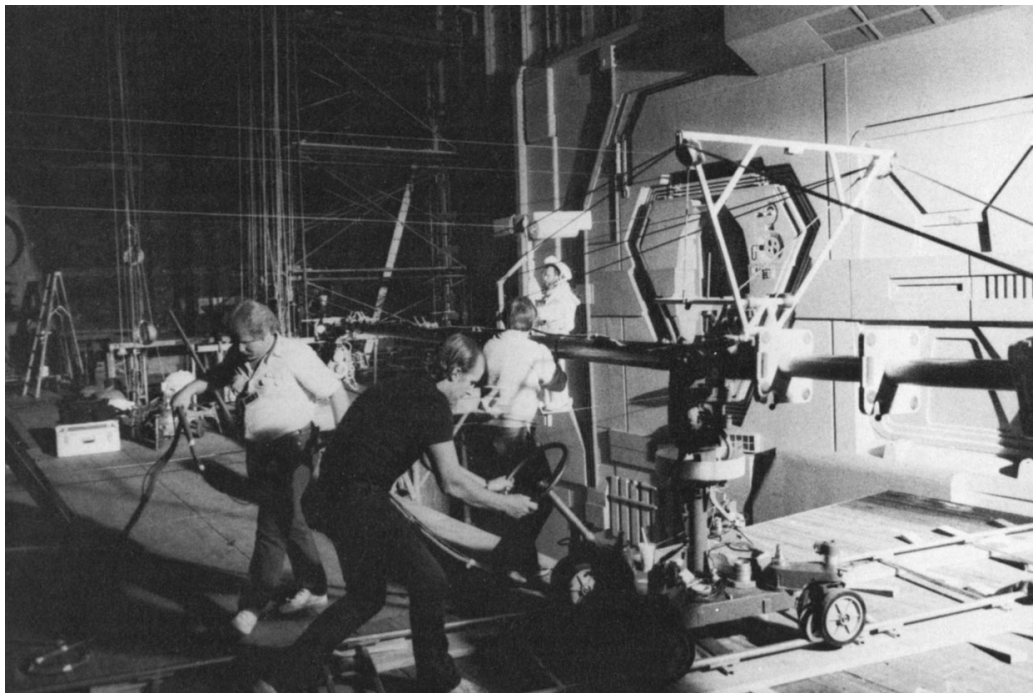
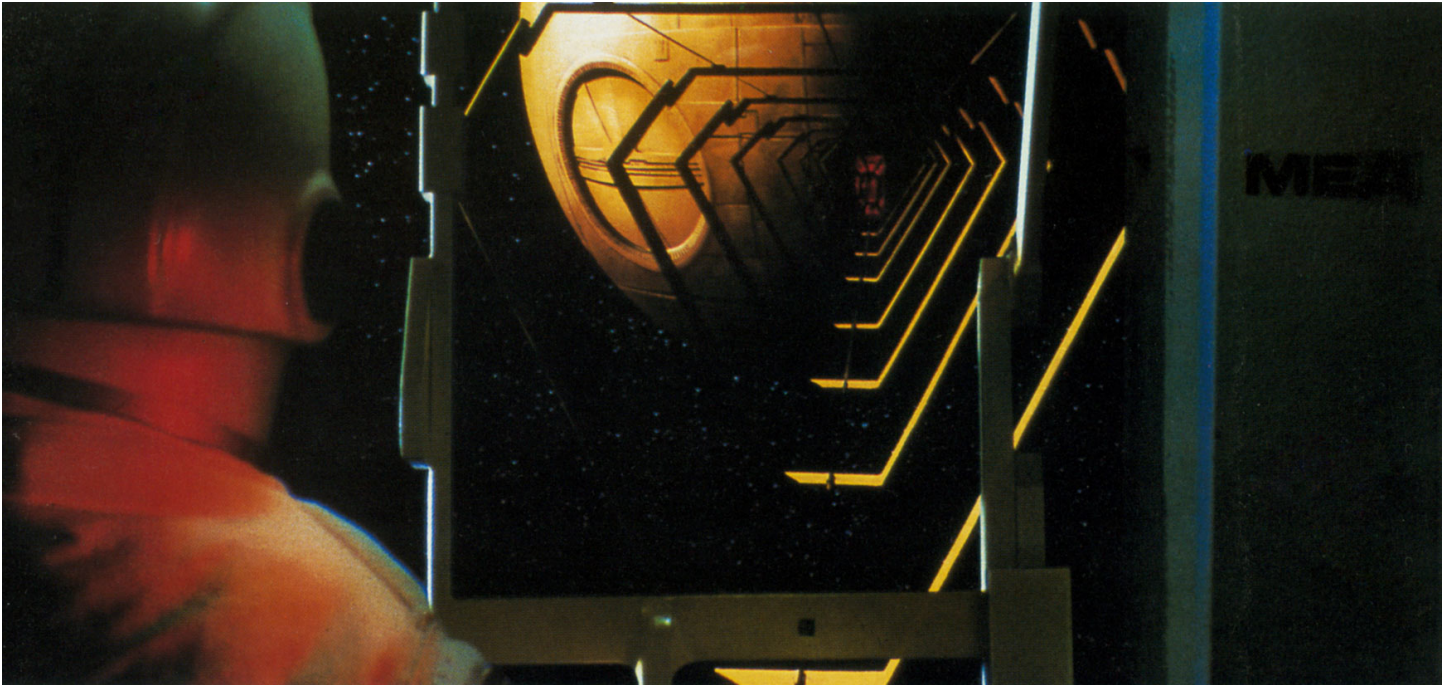




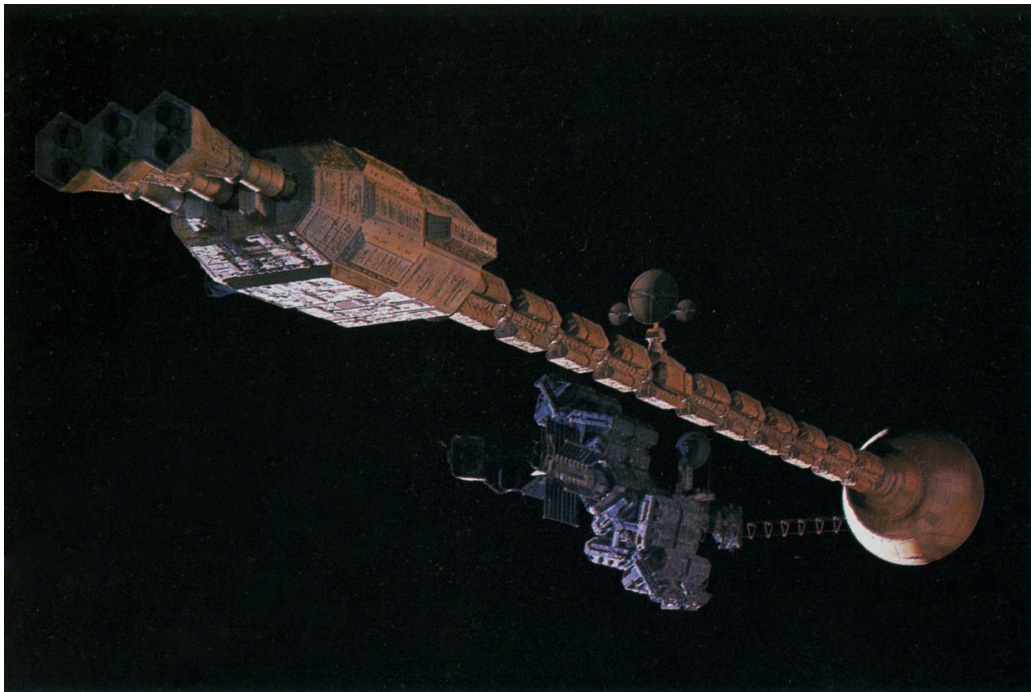
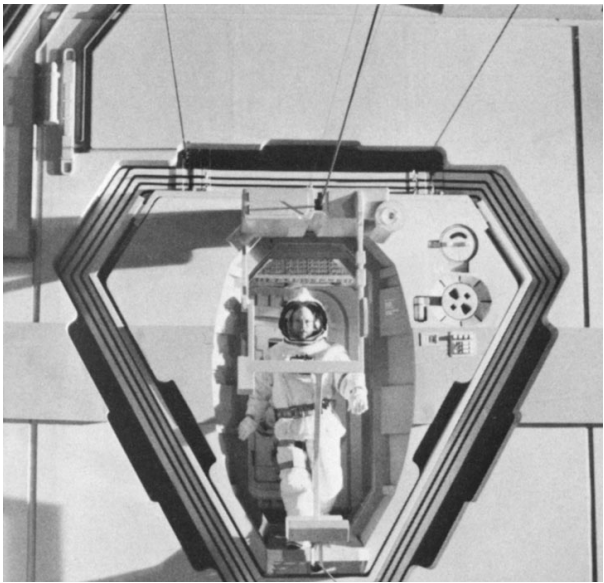
different formats. First, there was the English-language material to be used on earth during the opening scenes of the film. Second, there was the material to be used on the *Discovery*, which was designed to mimic the graphics look of *2001*. And last, there was the Russian-language material that would be employed exclusively on the *Leonov*. The latter, not surprisingly, proved the most difficult. "For the Russian graphics," said McMurry, "John and Richard had to create Russian fonts and then relabel the keys on their computers with Russian characters so they could write Russian. We weren't given any specific idea of what kinds of Russian text were wanted, except for a few things that Peter had specifically in mind. So John and Richard went through the script and tried to extract as much terminology as we thought we might need, and we gave that to the production office and they had their translator work it out for us. At the same time, we went to the library and found a pretty large volume of appropriate technical terms that were translated in Russian. So we made every effort to make sure that the Russian would be right. Even on the set, I was often asking the Russian actors if what we had was correct — and I was very pleased, in most cases, that we hadn't made any real blunders."

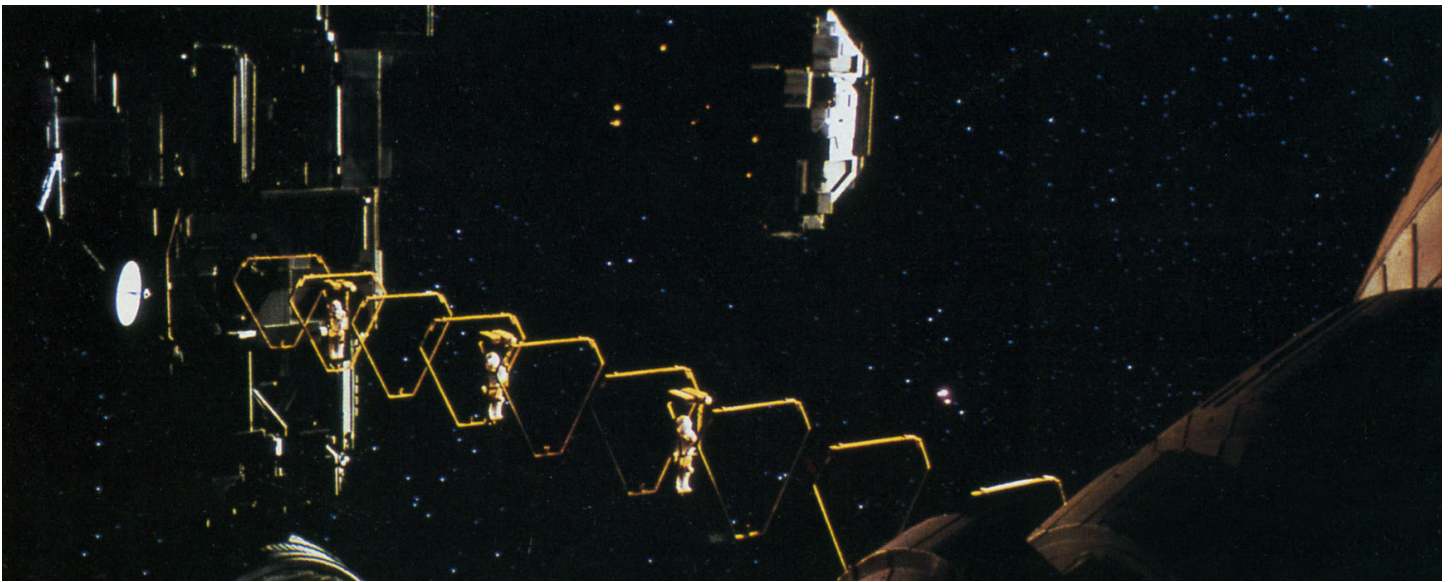
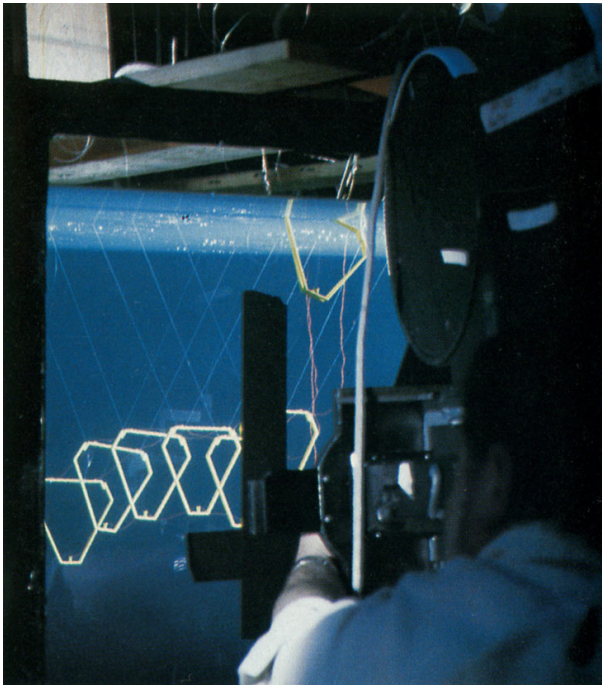
Although much of the Video Image material would be nondescript background filler, certain scenes — specifically during the Europa probe sequence — would be prominently featured and had to correlate closely with the motion control videography then underway at EEG. "The way Peter envisioned the Europa probe sequence," McMurry explained, "was that everyone would be crowded around two monitors on a very cramped bridge — one monitor having the live-action view being sent back from the probe and the other one having the computer simulation, timed exactly to it. One way we could have done it would have been to feed EEG's live-action video image into the computer and then colorize it or something. But we thought the real thing would be better, so we decided to do a computer model of the whole planet surface and do a simulation. Ideally, we should have had the EEG footage before we began, but because of the time crunch and the delay involved in getting the Sony stop-motion system up and running, we had to start generating our mathematical model of Europa before Clark and Dave ever started shooting the motion control video work. Otherwise, we probably wouldn't have finished in time, especially since our footage took just as long to generate as theirs did — maybe a little longer since we didn't just have a model to rake our camera over. Every frame had to be generated out of computer memory. We began by having Virgil Mirano take a lot of pictures of their model surface. Then John and Richard broke the surface up into quadrants and digitized all the little sections so that they had in their computer a model of the planet surface they were going to shoot. From that point on, all they had to do was plot their computer moves to move right

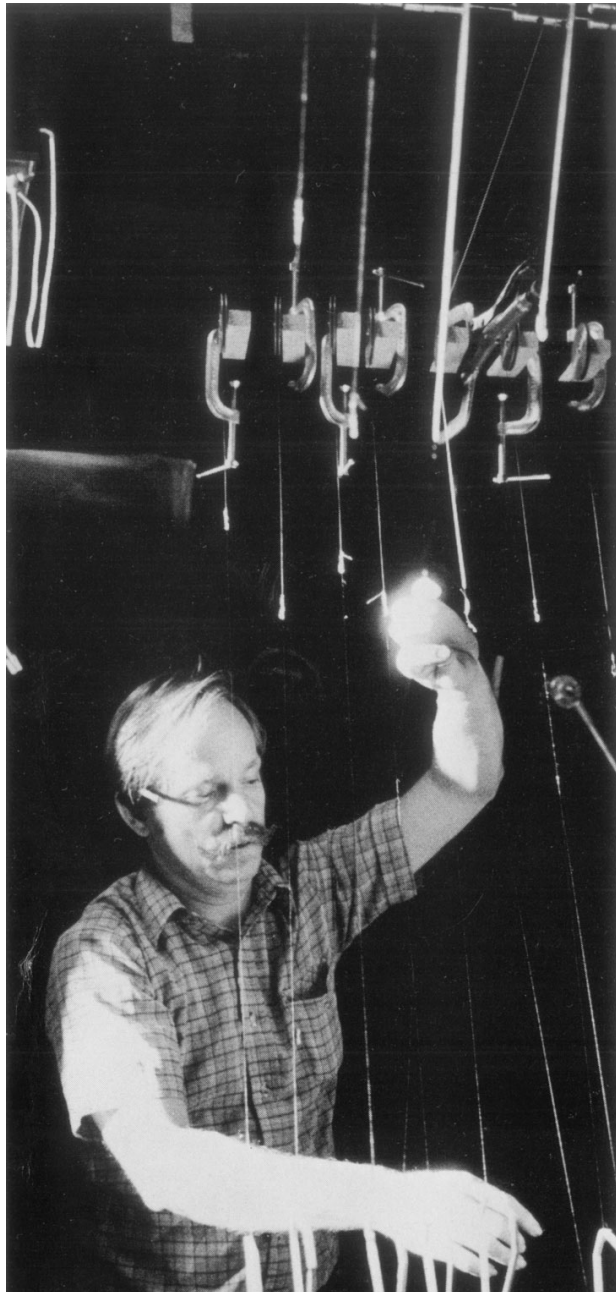
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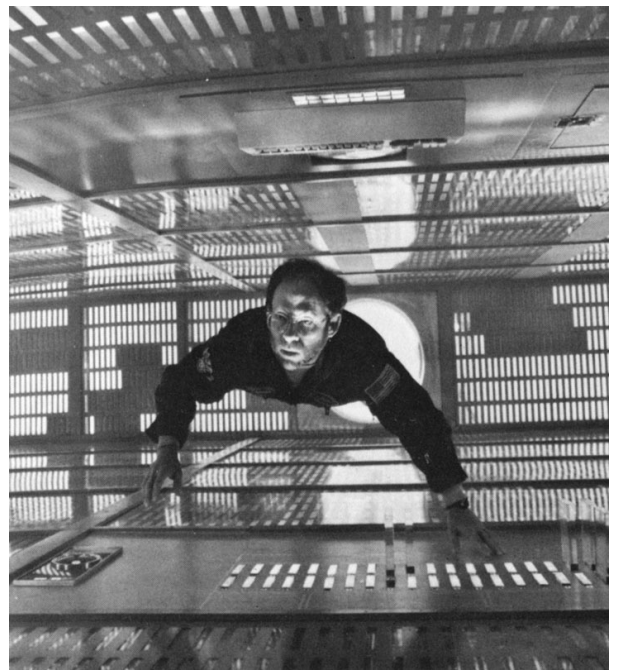
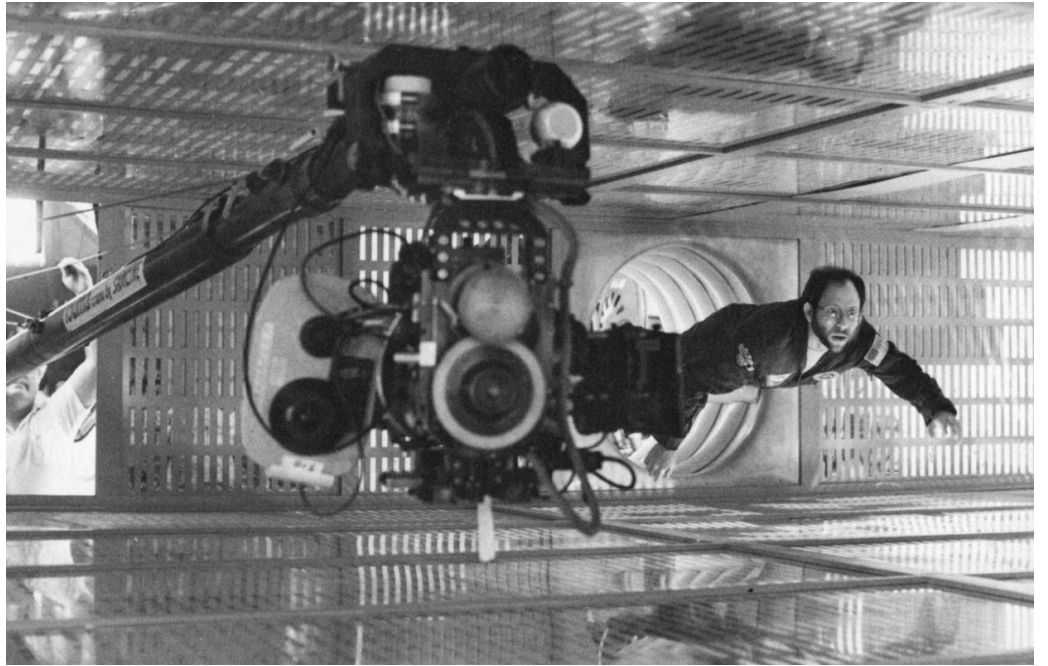
the spaceship model, none of the original sets or plans existed, so Brenner and his staff had to work from enlargements made from a 70mm print of the original film.

Although the basic layouts for the *Leonov* interiors were devised by Brenner, much of the detail work was the result of Syd Mead's input. "Once Al had established the floor plans in terms of size and to accommodate the camera angles Peter was planning," Mead explained, "I was given some of the set drawings and asked to overlay their basic shapes with specific detail — like gauges, television cameras, readout screens and switch rows." While much of the detail Mead created in drawings of the interior sets was conceived to look very futuristic and space-oriented, one particular detail was not. "Peter asked me to include a periscope in the design. The whole mentality of the film was of being in this container, this very close set of quarters, and Peter toned it deliberately to create a compressed, claustrophobic look. To further enhance this feeling, he said: 'We need a periscope. Think up a periscope that will look logical in outer space.' So I put together a classic periscope assembly of something coming out of an overhead surface, established a console work station with an eyepiece off to the side and a calculator keyboard with manipulator buttons. And it came off as a periscope — but an astral periscope where they could look and find stars and do their astral navigation with a hands-on fixture." Mead's periscope, no doubt, was one of the reasons Brenner came to refer to the *Leonov* interior settings as "Das Spaceship."

Once the interior set designs were approved, the task of their actual construction fell to special effects supervisor Henry Millar, who also added a lot of additional surface detail as his crew completed the settings on two of M-G-M's largest soundstages. "We worked from the artist renderings," Millar recalled, "but since they were somewhat sketchy, we had to do a lot of building just out of our heads. The drawings gave us dimensions and the basic design of the space; but beyond that, we just had to try different things until we could fill up a whole board and make it look like something. It was really kind of crazy for about the first two months, because we had to try a lot of different things until the sets had the look that Peter Hyams wanted. Then it involved a great deal of designing for the wiring and electronics end of it. At one point, we had fifty-nine men working on the sets, just in my department alone.

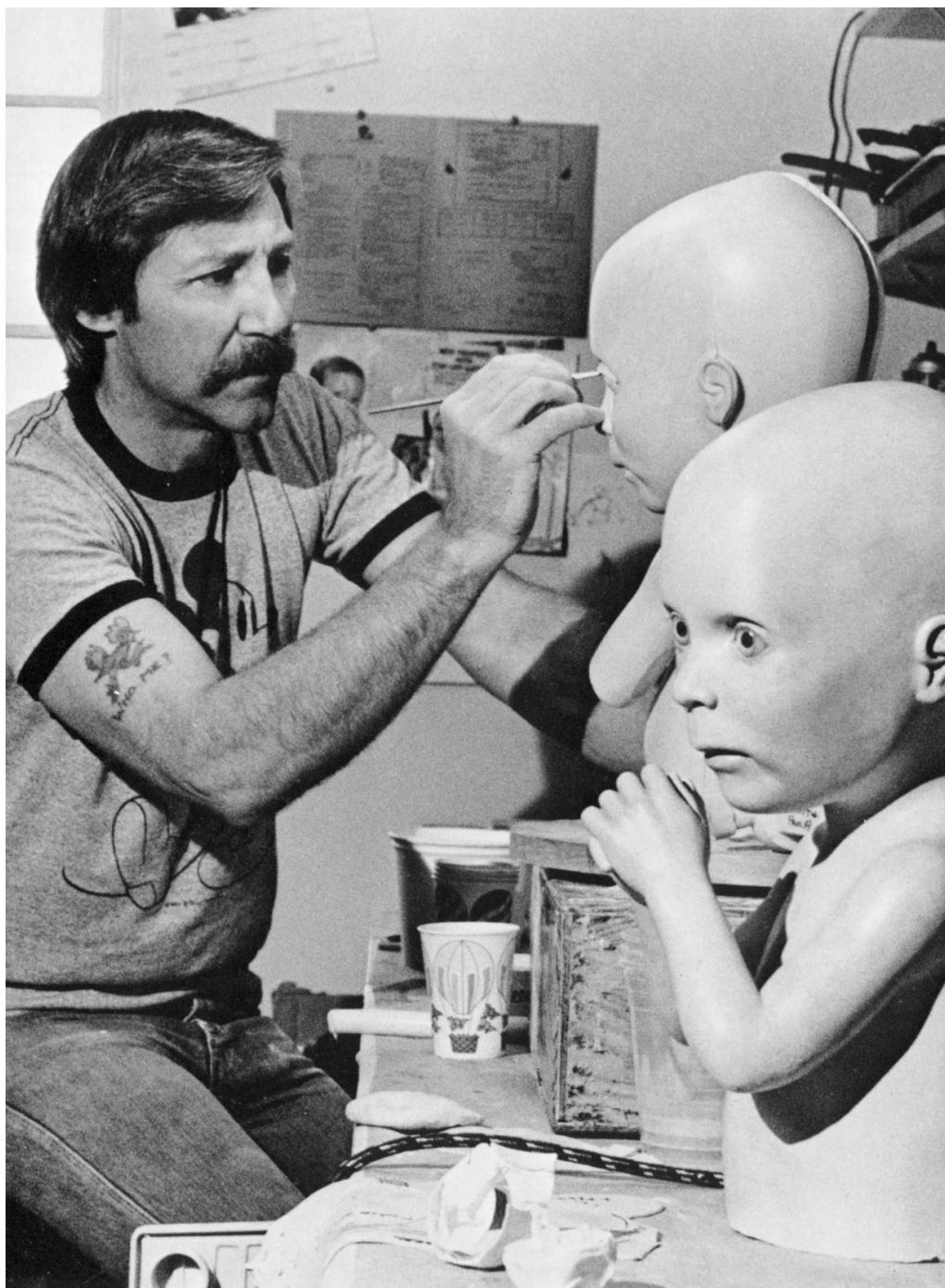
"It took us four months to build everything. We started out working ten-hour days, but that soon went up to twelve. We had a regular assembly line going, with one group doing the electronics and another doing the fitting and building. Every one of the buttons and knobs on the set had to be individually cut out of plexiglass, because they had all different shapes, and then all the plates that went around the switches also had to be cut out of aluminum." Consoles featuring these switches were

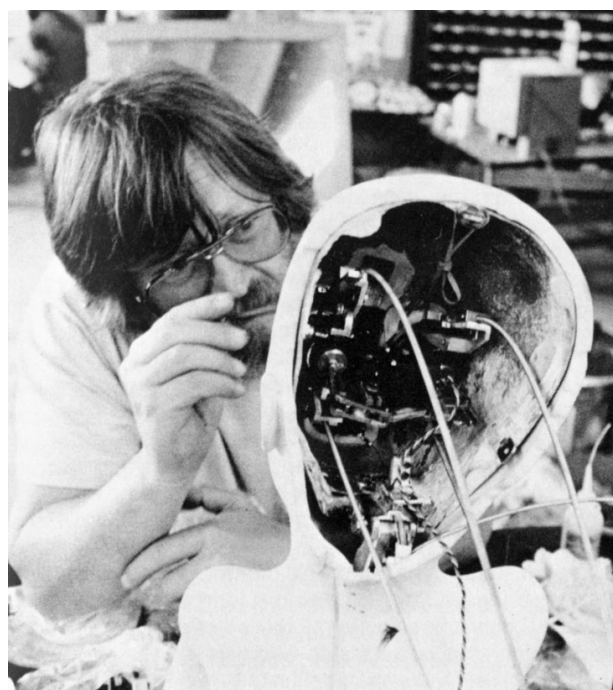
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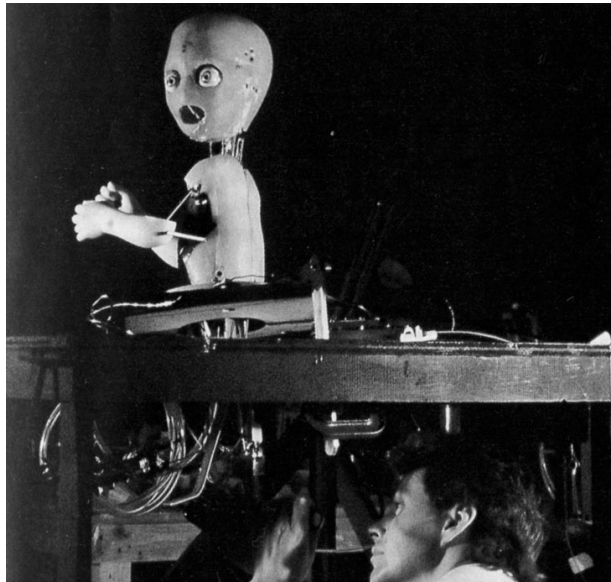




NASA footage and we know that out there there's just one key light and no fill, unless it happens to be light reflected off some surface. So I started thinking about utilizing a front-projected blue system for the models and the actors, as opposed to using a blue screen. That way, we wouldn't have to get into using fill light. So we started experimenting with front-projected blue and then I found out that Apogee had, for another purpose, built their own front-projected blue system. Since their equipment was already available, we were able to rent it from them and then spend a couple of months tweaking it out and modifying it to our needs. We called it a 'blue flux' system — I think they called it 'blue max' — and we used it to shoot almost all of our spaceman wire work over at M-G-M. So, that system was really the basis for our look on *2010*, which involved a lot of negative space. There is a lot of blackness in the shots, with finely chiseled backlit miniatures carving their way through it. It gave us the opportunity to create a different look; and it gave Mark Vargo the opportunity to produce some of the finest composites I've seen on the screen. It's a more realistic look, and since *2010* was not a fantasy movie, we couldn't take poetic license as often or as profusely as we did with *Star Wars*."

Production for *2010* officially began on February 6, 1984, a full twenty years after Arthur C. Clarke and Stanley Kubrick had first discussed their ideas for *2001: A Space Odyssey*. Among the earliest sequences to go before the cameras was the spacewalk, which not only inaugurated the blue flux system, but also involved extensive wire work. While many actors openly detest such semi-stuntwork, John Lithgow found the experience generally exhilarating. "The big central sequence where I and my Russian counterpart do an untethered spacewalk from the *Leonov* to the *Discovery* is what really attracted me about the whole project. I thought it would be wonderful, because people are fairly familiar with weightless spacewalks from news footage and everything, but those walks are always performed by super-trained and efficient and problem-free astronauts — nothing ever really goes wrong. In *2010*, my character is an aerospace engineer, but the interesting thing about him is that although he's a rocket expert and a troubleshooter, he doesn't know anything at all about being an astronaut. As a result, during his lengthy spacewalk, he's panicked by the whole operation. So there I was again, afraid of flying — sort of a 'Nightmare at Several Million Miles' type thing. Once Curnow reaches the *Discovery*, he clings on for dear life and is covered by this yellow sulphuric powder, so he gets filthy dirty. So the whole sequence created this feeling of a tactile, realistic man in

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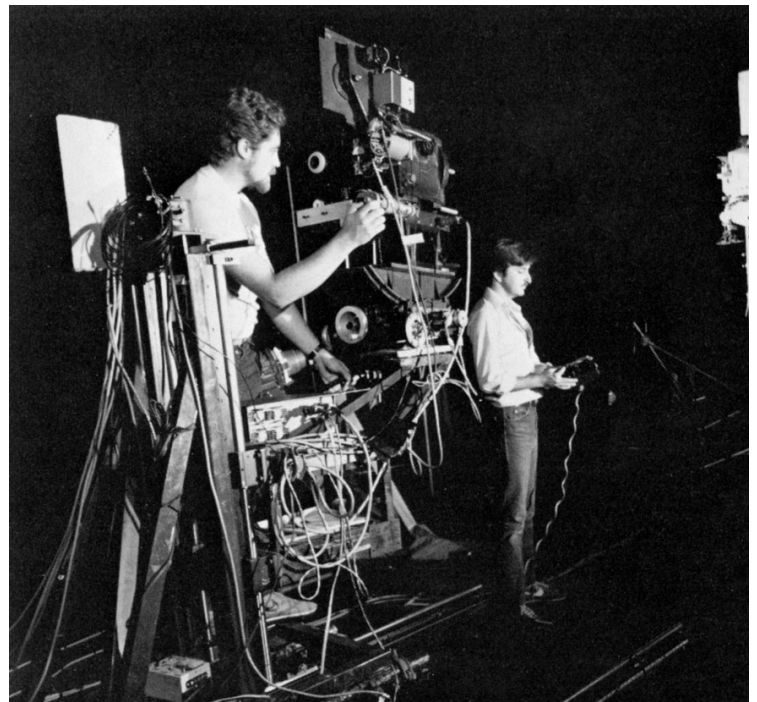
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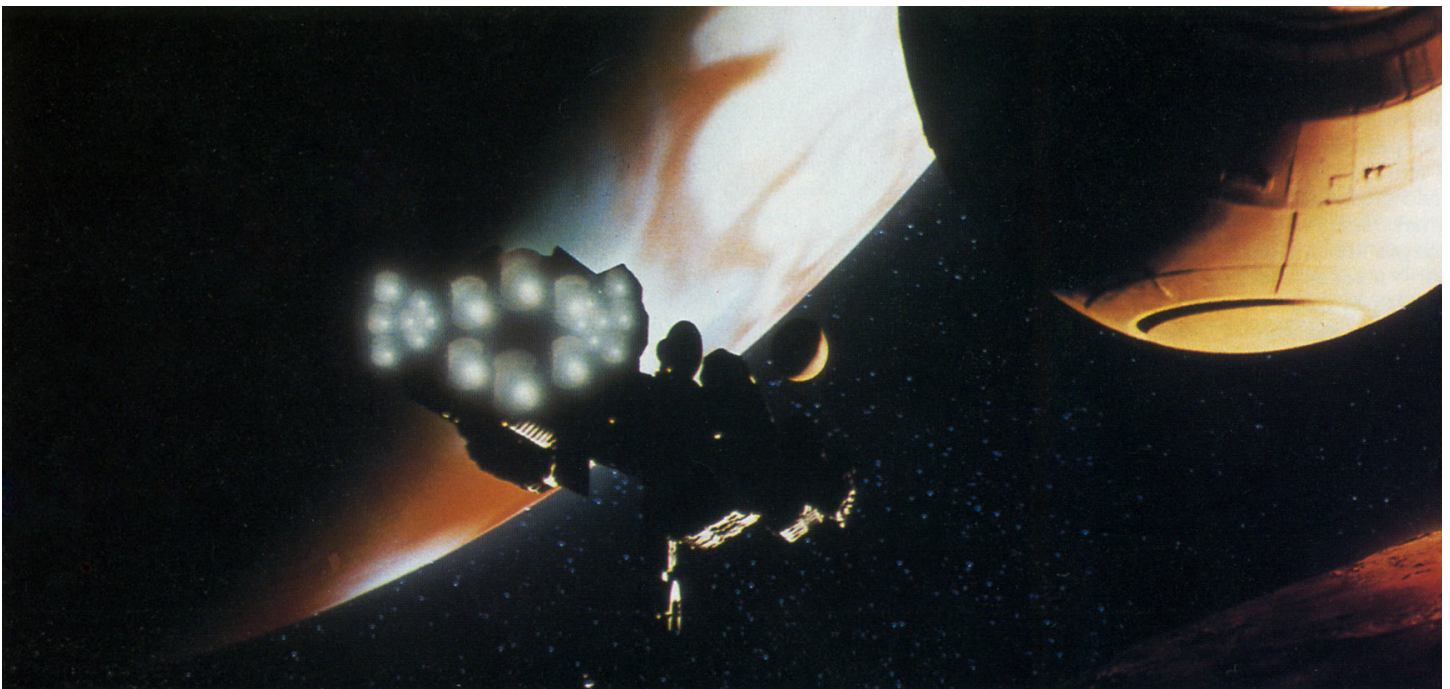
With 205 miniature shots, requiring a total of 823 elements, the job of efficiently scheduling people, equipment and stage space was especially important. "In a space movie, obviously, no one is actually out in space with a camera, so everything is shot separately for the most part," said production supervisor Michael Kelly, whose background as a live-action and effects editor afforded him a keen sensitivity to the importance of minute details. "For maybe fifteen minutes of total running time, we have to produce — if we count matte passes — close to 1200 separate pieces of film. By comparison, *Honkytonk Man* — another film I worked on — was about a 700-scene movie, and that was two hours and two minutes. So in terms of what the realities are, producing fifteen minutes of effects is as complicated as doing a whole live-action movie — maybe more so, because it's not just a matter of going in and getting the set and everything ready and then filming. It's a matter of coordination and communication over a period of months — shooting a *Leonov* today that will be combined three months from now with a *Discovery* that was shot six weeks ago. So once the storyboards are developed, we start analyzing them very carefully, shot by shot, determining what size model is to be used, whether it is to be coming toward the camera or going away — things like that. Then we try to consolidate all the shots that would benefit from having a particular model mounted in a particular way and try to shoot them all at once on one stage, rather than jump around and waste a lot of time on totally different setups."

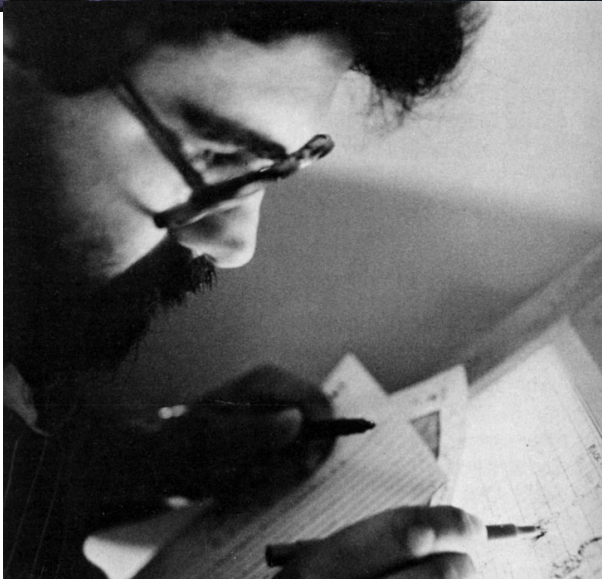
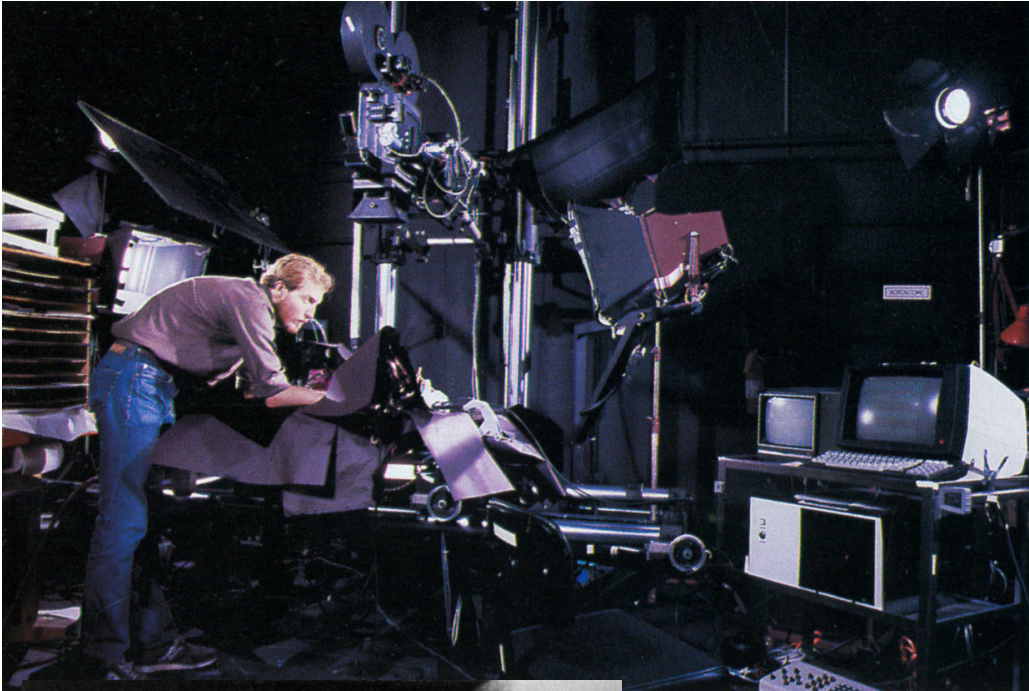
Although the blue flux system proved altogether satisfactory for the live-action work at M-G-M, it was not an ideal system for the model photography. "It's a big, ornery, hard-to-handle system," Morris commented. "It uses a real high-output xenon lamp with color correction filters — and a beam splitter that hangs on the camera. It works well, but you'd have to have one hell of a motion control rig to handle that big a thing! It would have been real difficult on the model stage, especially when you consider some of our light passes run up to eight hours." As a result, most of the traveling mattes for the models were accomplished using the frontlight/backlight system, which involves a minimum of two passes on the model — one frontlit against black and a second one silhouetted against white. The technique had long been standard under Trumbull and Yuricich, but to accommodate *2010's* jumbo models, key grip Pat Van Auken constructed two new screens — twelve feet high by thirty feet wide. "All they were," Morris continued, "was seamless



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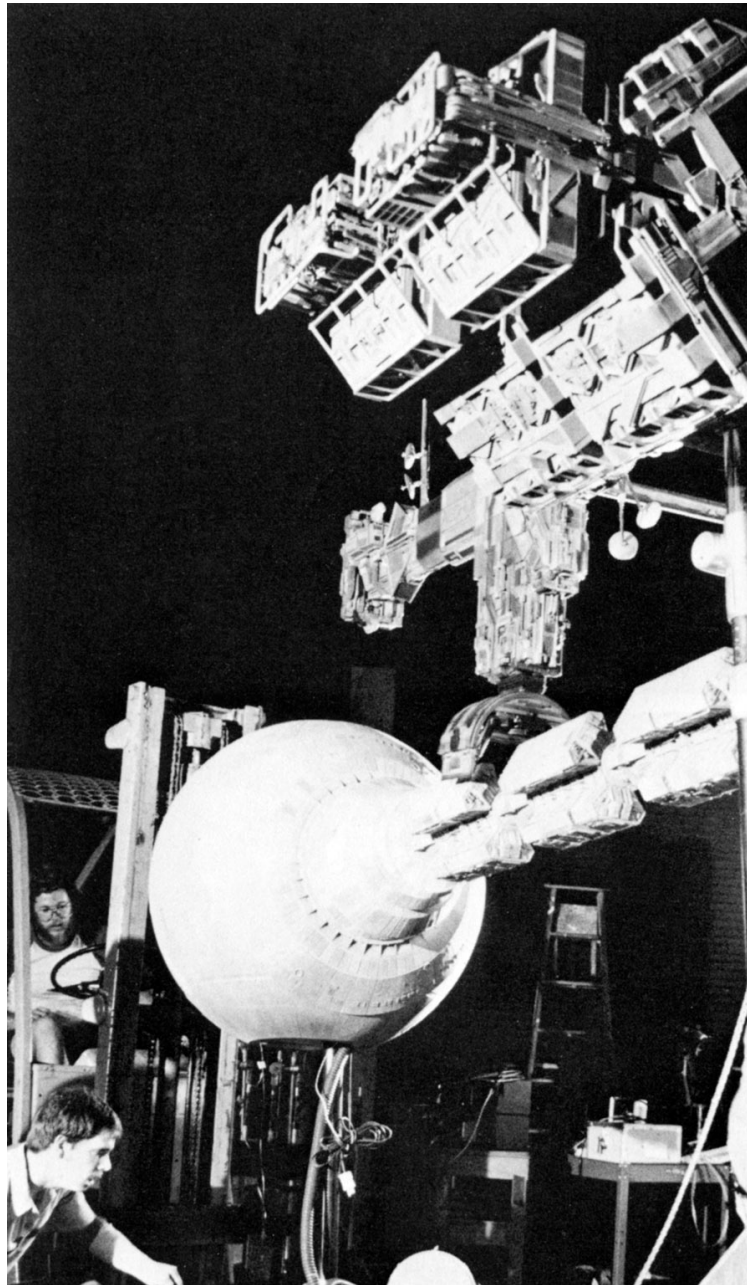


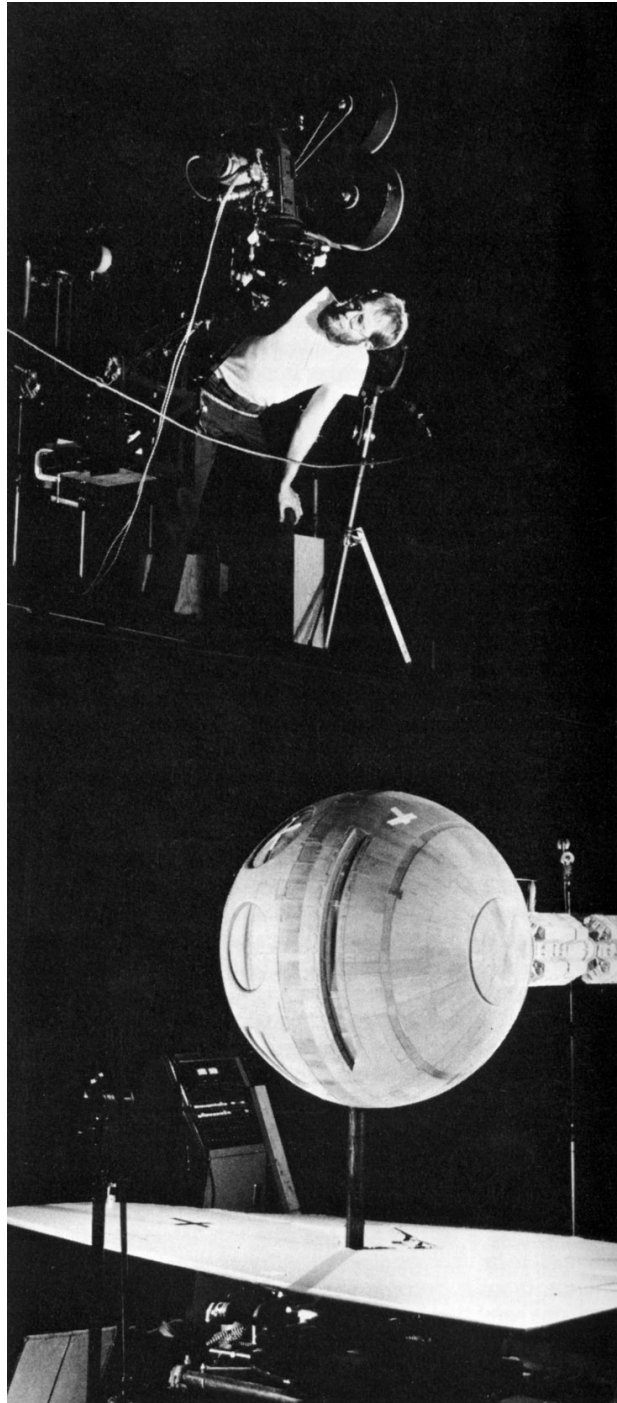


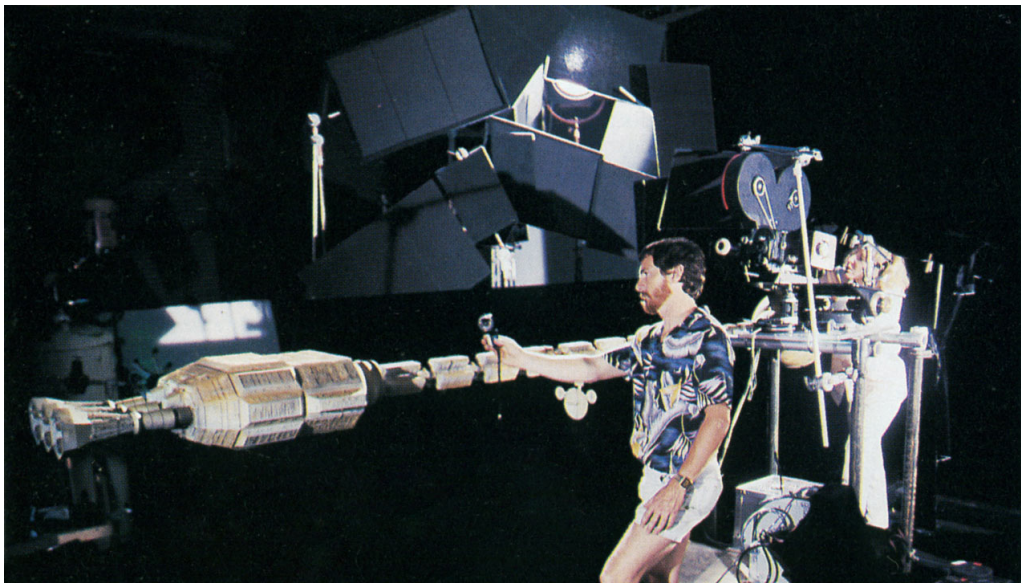
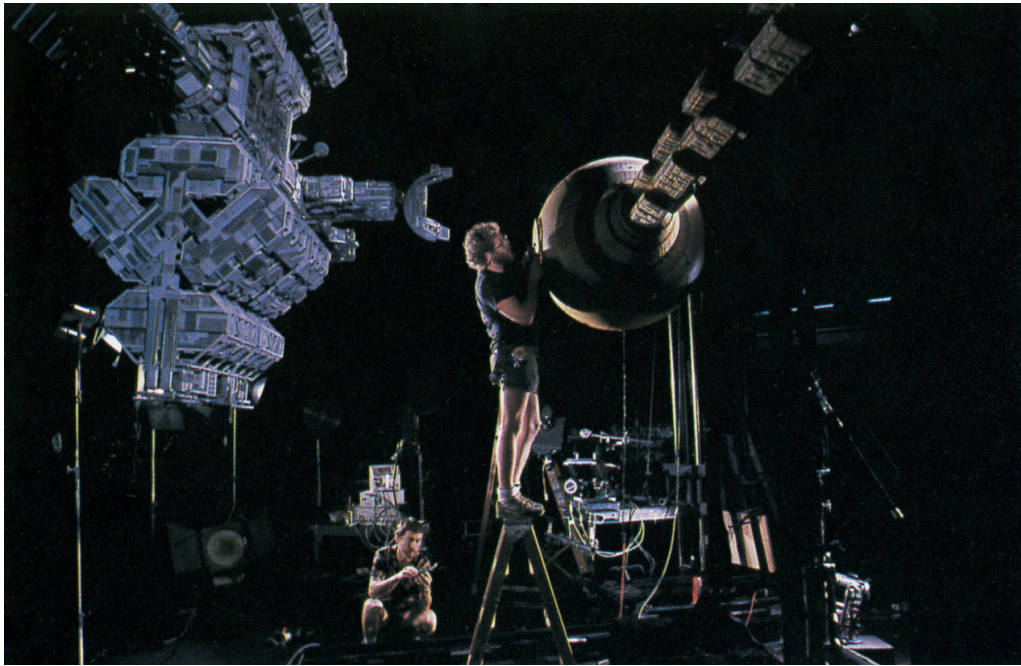
scientists and astronauts turn their attention to the real focal point of their mission — the monolith. Floating just kilometers away from the two ships, the mysterious black slab at first remains a silent giant apparently unwilling to reveal its many secrets. While the monolith in *2010* looks identical to the one in *2001*, it was created for the sequel in a way quite different from the original. "We chose to do them all as matte paintings as opposed to dimensional models," Edlund noted. "Generally, the most difficult kind of object to light is a spherically-shaped one because of the problem of it reflecting light. But the second most difficult shape to photograph would probably be something like the monolith because, first of all, it had to be perfect. It could not have any flaws on its surface. That's one of the points brought up by Clarke in his novel — that the monolith is theoretically perfect. The thing is also described in the book as being totally reflectionless — but in a practical sense, you can't really show anything that's squarish without seeing tones. So George Jenson and our matte painting master, Matthew Yuricich, worked out a scheme of creating the black monoliths with paintings, showing a little bit of light here and a little bit of light there, with these little bits of light being just a few tones off black. It was a difficult task."

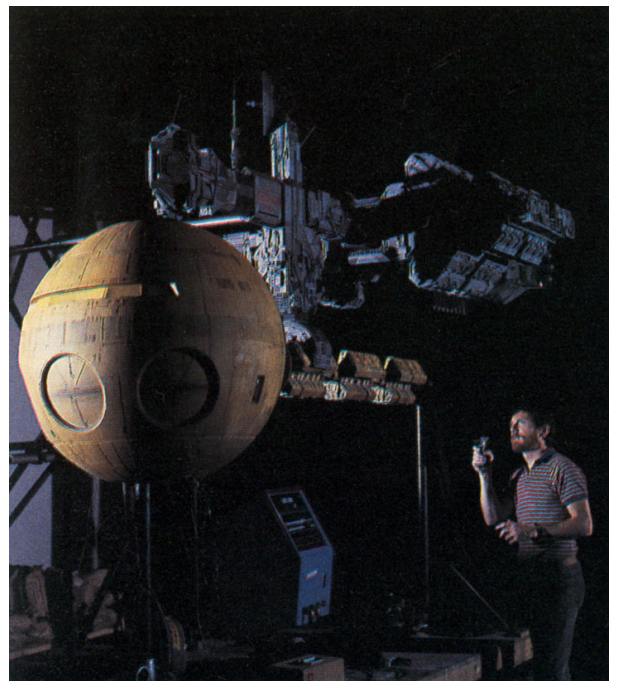
"It was very hard work," Yuricich concurred. "We had about thirty monoliths to paint, and it was tough to get the look of them to balance properly. I think Peter Hyams didn't like the idea of using miniatures because they would have been too shiny and sometimes they would have showed some texture. He wanted the monoliths to look shiny, but not *real* shiny, and to look like they would absorb light — kind of blackish, although some of the ones in *2001* were actually a little bluish-green. So we started painting them until we finally hit on a formula that he liked. Michelle Moen did most of the monoliths and it was a real labor. Because they really are just made out of different tones of black, the completed paintings never looked like much when we were done, but the blends would show if they were not quite right. We had to give some character to them — we'd try to give a little light to one edge and just the opposite to another to give them some composition."

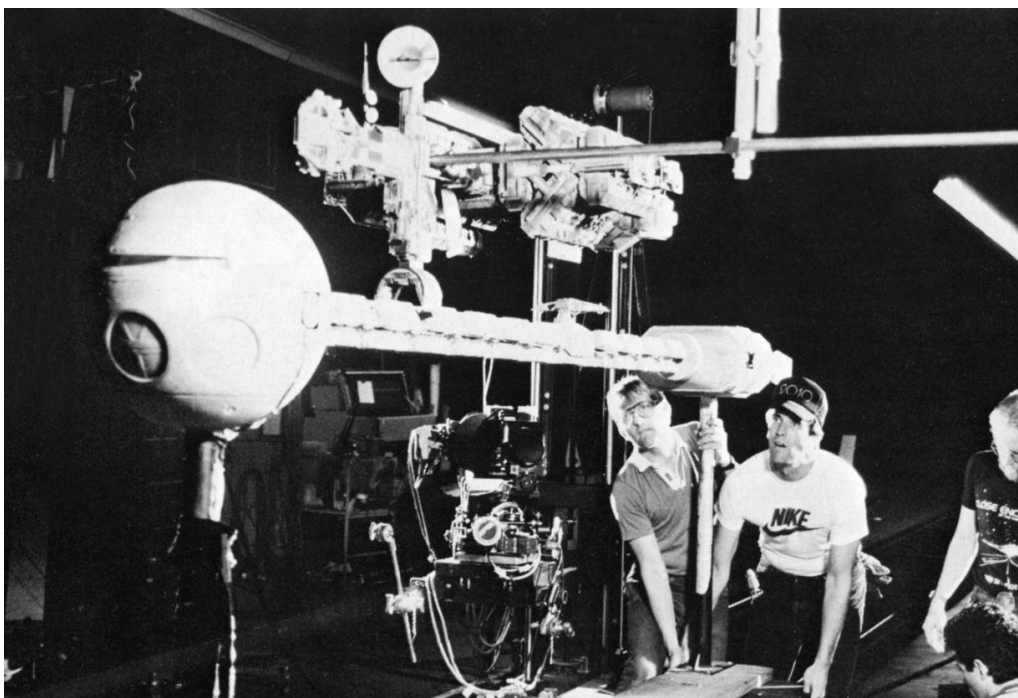
To create the look that Hyams wanted, Yuricich and Moen found that not only did they have to paint the monolith in shades of black, but they also had to paint it on a black background. "We tried it once on white," Yuricich continued, "but the matte showed a little edge around it. So we decided to paint black on black, and I had all the background boards painted black. Then, I would leave alone the area wherever the blackest part was and just paint the lighter, greyer area. Some of the first blacks that we painted were too flat so we had to use some oil to bring some gloss back. Trying to get enough gloss in there without it becoming too shiny was a real problem. We used one paint that looked almost like a mirror, and Peter didn't







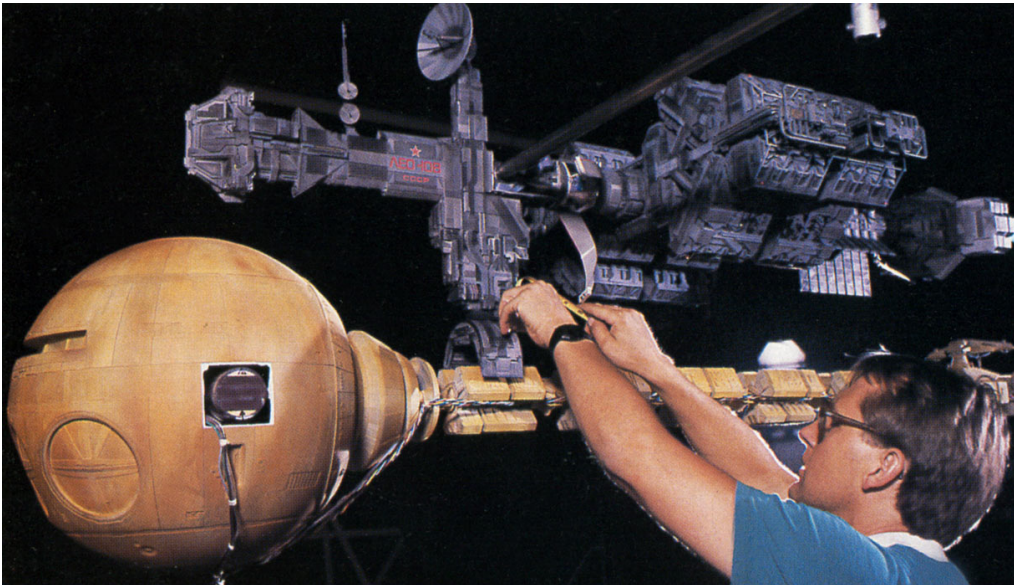




enough attention. It was unbelievable. I building with all these guys — walking I but I couldn't deal with it. I was just too were coming up on the date where we had and do a test shooting at M-G-M. I think we were supposed to do that; and on Wednesday before, I decided I'd better project. And suddenly I realized that no *Ghostbusters*, we could get away with tures because they weren't human; but on the human form, we found ourselves in situation. The level of technology that I first film just didn't work at all on the realized that there was about six weeks done on it, and we had to show it in 1 Richard that this was going to be a disaster.

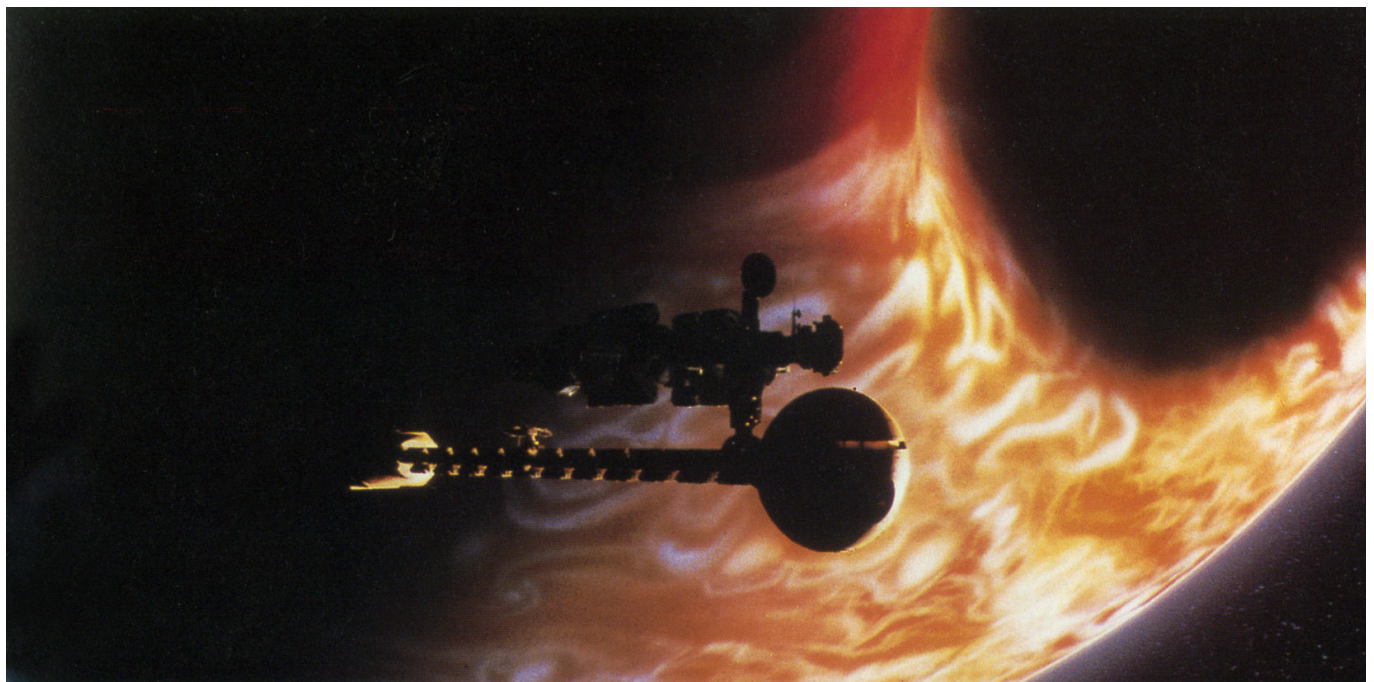
"We were under the impression that it to be photographed against a black background the original film," Culnan elaborated. "We that way and were fairly well pleased achieved. But when we got to M-G-M, we to be shot in the pod bay, with full in surprise was that the Starchild was not diffusion, which we were counting on to surface imperfections — especially since paint it with a high gloss paint, has a tendency flat under camera lights. So we had sort right from the start. Once we got the puppet rehearsing it. Including the puppete operators involved. At the start of the scene Then it was supposed to come up in a pod with the eyes looking into the camera and tracking over and coming into alignment. Unfortunately, the required movement of movement for the human wrist and finger started putting a strain on Teresa's arm for her to make subtle attitude adjustments the extreme movements she was attending to restrict the focus and blurring, pointing out a distinct physiological problem be difficult to overcome."

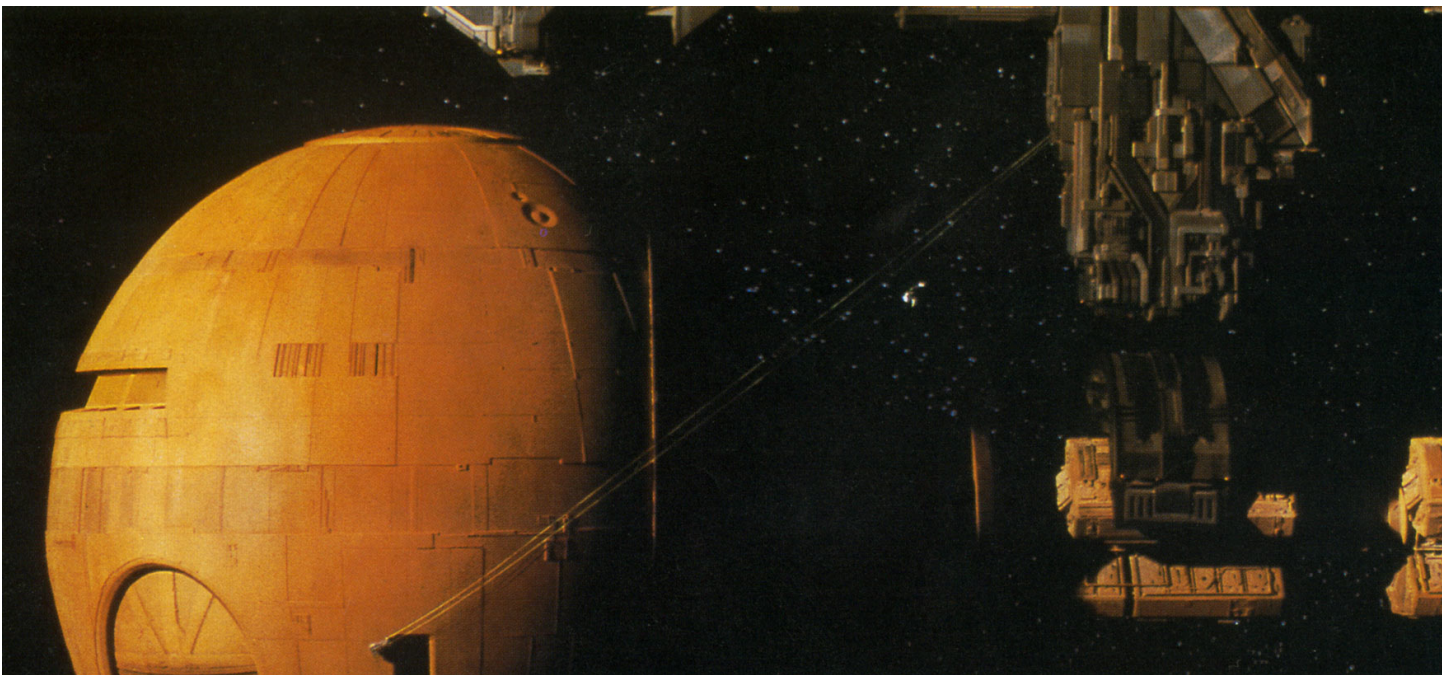
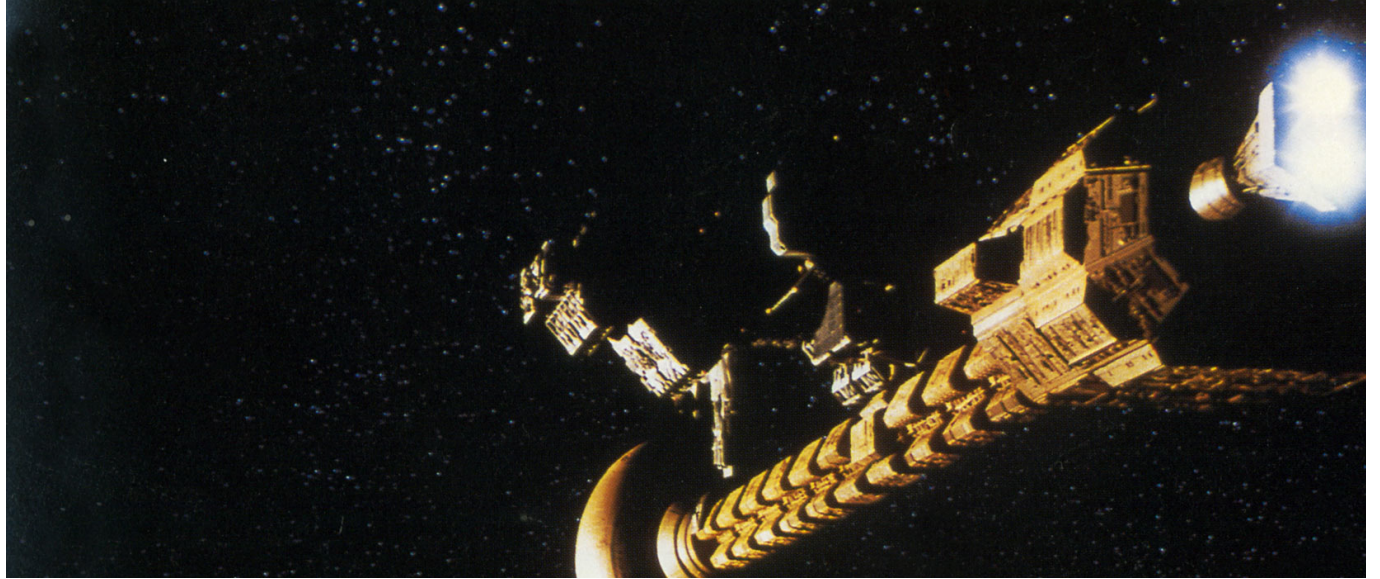
Despite a growing conviction that it was board time, the test was completed morning in dailies. "In the 70mm format Culnan lamented. "There was no opportunity any minor imperfections. The flatness

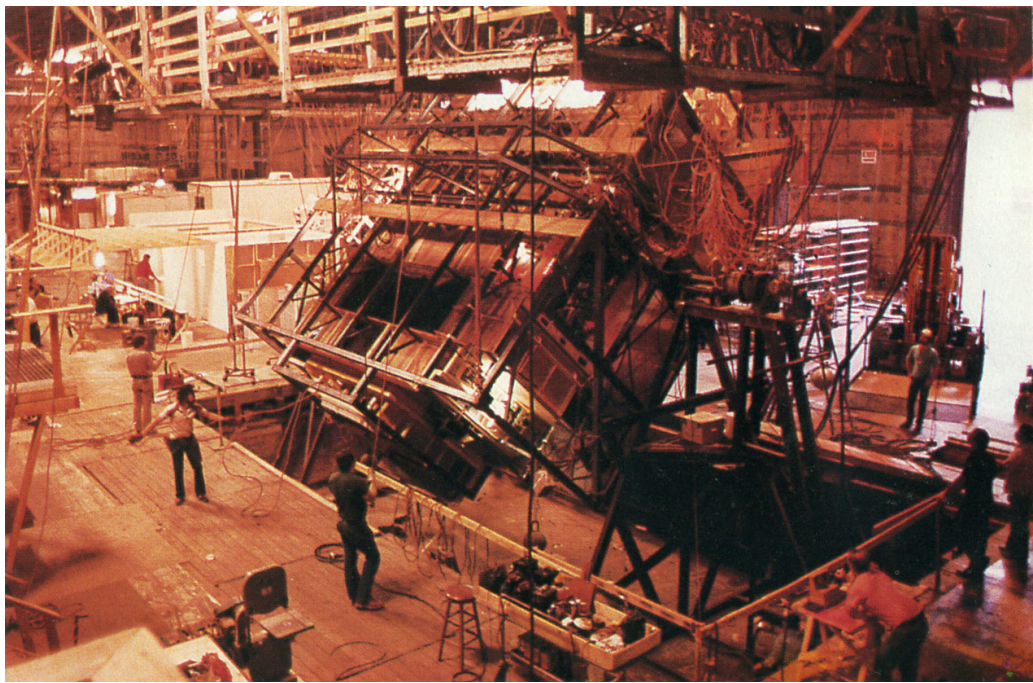
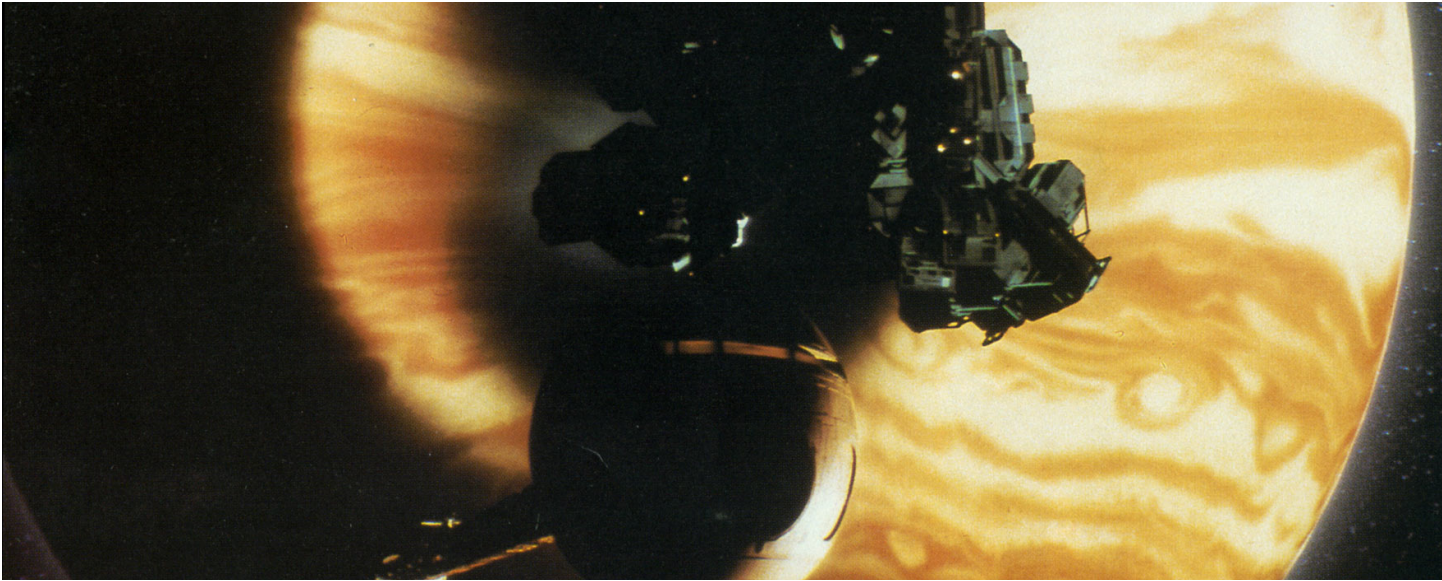


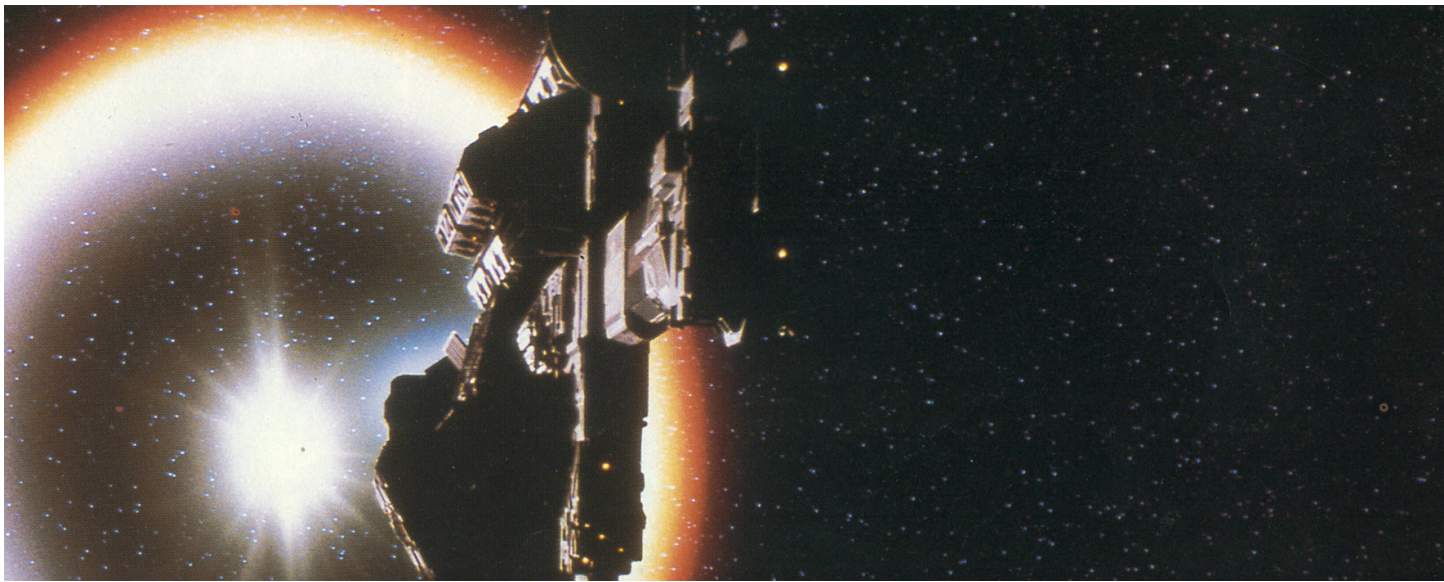
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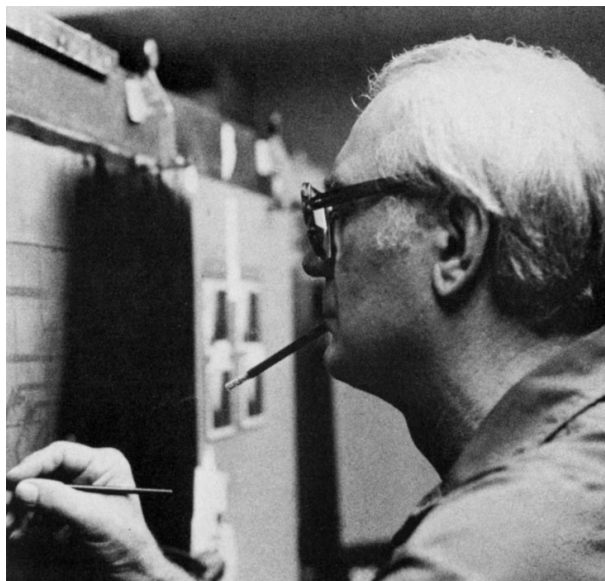












why it was so important to keep our final ratio as low as possible. And there was that normal amount of redesigning and dropping and adding shots after we spent a lot of time getting them to finals, which drove me crazy. The shots were real long, too, and that was another thing that bothered me. Not only did we have twice as many shots, but the length of them was twice to three times as long as on a normal effects movie. So when we had to reshoot something that was maybe a hundred-frame shot and took an hour to shoot, then that meant it became a two-hour shot. It was real involved. If we had to reshoot due to a matte problem or an editorial problem, then that long black center had to be remade. So it was a cumulative thing. *2010* was a big show — probably about 350 or 360 shots — and when you end up counting the footage shot, the line-up time and the element time, that's a lot."

"In any of the optical shots," Edlund added, "the balance was so critical that we had to use color correction filters that were so pale you could hold them up to the light and barely detect any color in them at all. Mark did an incredible job of balancing them and of optically massaging every aspect of them so that their seams wouldn't show. At the end, he had an incredible record for number of takes needed to get a final version, something like about 2.3 takes to final. That has to be a record; and on many shots, he got them in the first take." Vargo, however, was unwilling to accept full credit. "I had a terrific crew. My camera operators, Chuck Cowles and Bruno George, were absolutely first-rate — as were my line-up people, Ron Moore, Mary Walter, Phil Barberio and Brad Kuehn. Pat Repola processed all our black-and-white mattes, and my optical coordinator, Laurel Walter, made sure everything came together. It was a great group of people, and we really hit our stride on this project."

Besides animation and optical, the one other department most often hit at the end of a film is editorial. For *2010*, visual effects editor Conrad Buff and his staff encountered several unique challenges — problems that often sent them on odysseys of their own through the thousands of feet of footage that accumulated during the production. "This film, theoretically, was supposed to look realistic," Buff said, "and selecting elements that were not motion control elements was more elusive because of the large volume of material. The shots were also longer and had to sustain themselves on screen longer. As a result, it was more difficult for us to find material that would hold up to scrutiny for three or four times the length of a shot in your typical science fiction film. There were no battle sequences with a lot of quick cuts like you would find in *Star Wars*. And



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